

JPRS-EST-92-010
9 APRIL 1992



**FOREIGN
BROADCAST
INFORMATION
SERVICE**

JPRS Report

Science & Technology

Europe

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL INFORMATION SERVICE
SPRINGFIELD, VA. 22161

19980518 119

Science & Technology

Europe

JPRS-EST-92-010

CONTENTS

9 April 1992

WEST EUROPE

ADVANCED MATERIALS

| | |
|--|---|
| Netherlands: High-Temperature Ceramic Membrane Developed [Harm Ikink; Rijswijk POLYTECHNISCH WEEKBLAD, 16 Jan 92] | 1 |
| German Team Develops Corrosion-, Heat-Resistant Steel Alloy [Bonn DIE WELT, 8 Feb 92] | 1 |
| Sweden: Consortia for Advanced Materials Research [Anders Wallerius; Stockholm NY TEKNIK, 6 Feb 92] | 1 |

AEROSPACE

| | |
|---|---|
| DASA's View of Market for Proposed Regional Aircraft [Duesseldorf HANDELSBLATT, 5 Mar 92] | 3 |
| Contactless Laser Metrology Used in German-Dutch Wind Tunnel [Bonn WISSENSCHAFT WIRTSCHAFT POLITIK, 29 Jan 92] | 3 |
| Italy: ERS-1 Satellite Becomes Operational [Rome AIR PRESS, 5 Feb 92] | 3 |
| Bavarian Government Takes Stake in German Aerospace [Bonn DIE WELT, 13 Feb 92] | 4 |

AUTOMOTIVE INDUSTRY

| | |
|---|---|
| Germany: New Prototype Joins Electric Car Market [Bonn DIE WELT, 22 Feb 92] | 4 |
|---|---|

BIOTECHNOLOGY

| | |
|---|---|
| Commercialization of Hepatitis "A" Vaccine Analyzed | 5 |
| Need Questioned, High Cost Criticized [Jean-Yves Nau; Paris LE MONDE, 5 Feb 92] | 5 |
| Merits Questioned [Jean-Yves Nau; Paris LE MONDE, 5 Feb 92] | 7 |

COMPUTERS

| | |
|---|---|
| Inmos, Perhelion Develop Transputer-Based CAD Station [Berlin MIKROPROZESSORTECHNIK, Feb 92] | 7 |
| Germany: Use of Supercomputers for Research [Siegfried Muench; Berlin ING DIGEST, Mar 92] | 8 |

DEFENSE R&D

| | |
|---|---|
| Italy: Government Holdings Set Up Defense Hub [Susanna Petrini; Milan L'INDIPENDENTE, 13 Feb 92] | 8 |
|---|---|

ENERGY, ENVIRONMENT

| | |
|--|----|
| EC's Environment Action Program Introduced [Antwerp DE FINANCIËEL-EKONOMISCHE TIJD, 7 Jan 92] | 9 |
| Germany: Development of Wind, Solar Energy | 9 |
| Wind Energy Technology [Burkhard Boendel; Duesseldorf WIRTSCHAFTSWOCHE, 10 Jan 92] | 9 |
| Solar Energy in Houses [Ulf J. Froitzheim; WIRTSCHAFTSWOCHE, 10 Jan 92] | 10 |
| Communal Solar Energy Examined [Rainer Praetorius; Duesseldorf WIRTSCHAFTSWOCHE, 10 Jan 92] | 12 |
| Bayer Developing Polyurethane Recycling Process [Paris COMPOSITES ET NOUVEAUX MATERIAUX, 26 Feb 91] | 13 |

| | |
|---|----|
| Germany: Fiber-Reinforced Pistons To Reduce Diesel Pollution [Richard Sietmann; Stuttgart BILD DER WISSENSCHAFT, Mar 92] | 13 |
|---|----|

FACTORY AUTOMATION, ROBOTICS

| | |
|--|----|
| Italian Institute Develops 3-D Seeing Robot [Rome ANSA, 29 Jan 92] | 15 |
| Italian Institute Presents MAIA Robotics Project Results [Nicoletta Castagni; Turin MEDIA DUEMILA, Jan 92] | 15 |
| Germany: BMFT Robotic Welding Project Results [Hans G. Baumann; Landsberg ROBOTER (EUROPEAN MARKET 1992), 1991] | 20 |

NUCLEAR R&D

| | |
|--|----|
| French Laboratory Develops Superconductive Particle Accelerator [Paris SCIENCES & AVENIR, Jan 92] | 21 |
| Quark Experiments at HERA Facility in Hamburg [Ulrich Straumann, Ralph Eichler, et al.; Zurich NEUE ZUERCHER ZEITUNG (INTERNATIONAL EDITION), 22 Jan 92] | 21 |
| Testing To Begin on European Synchrotron [Jean-Francois Augereau; Paris LE MONDE, 18 Feb 92] | 23 |

TELECOMMUNICATIONS

| | |
|---|----|
| Dutch Government Subsidizes 15 Communications Projects [Gerard van Nifterik; Rijswijk POLYTECHNISCH WEEKBLAD, 16 Jan 92] | 23 |
| Philips Italia Presents HD-MAC Laser Disc System [Luca Pavanel; Milan ITALIA OGGI, 31 Jan 92] | 24 |
| German Consortium To Equip CIS With Satellite Phone, TV System [D. Thierbach; Bonn DIE WELT, 7 Feb 92] | 24 |
| Thomson's High-Definition Television Sacrifices Image Quality for 16/9 Format [Paris LE MONDE, 19 Feb 92] | 25 |
| EUTELSAT To Increase Eastern European Coverage [Paris AFP SCIENCES, 13 Feb 92] | 25 |

ADVANCED MATERIALS

Netherlands: High-Temperature Ceramic Membrane Developed

92BR0209 Rijswijk POLYTECHNISCH WEEKBLAD
in Dutch 16 Jan 92 p 1

[Article by Harm Ikink: "Industry Enthusiastic About High-Temperature Membrane Module"]

[Excerpts] In cooperation with the University of Twente, Velterop Ceramic Membrane Technology in Heerhugowaard has developed a new module for the use of ceramic membranes in temperatures up to 800°C, thus allowing these membranes to be implemented in large-scale, high-temperature applications. The petrochemical industry in particular has expressed great interest. A worldwide patent application has been submitted for a special ceramic-metal interface. [passage omitted]

Patent

Velterop Ceramic Membrane Technology has recently introduced a new membrane module for very-high-temperature applications. Industry and, in particular, the large oil companies are extremely interested. Velterop developed the module in cooperation with the anorganic chemistry research group of the University of Twente. The Ministry of Economic Affairs subsidized the development through the Business-Oriented Technology Stimulation Program (PBTS). The new module permits the use of ceramic membranes at temperatures of up to 800°C and it withstands changes in temperature of up to 5°C a minute. It is a stainless steel cylinder with a 4-centimeter diameter which contains a hollow, permeable ceramic tube with a diameter of two centimeters. This tube is attached to the shell in such a way that mechanical stress and temperature effects cannot cause rupturing of the ceramic. Velterop solved the problem of shock absorption by fastening the tube on both sides to a closing piece [sluitstuk] using a flexible metal ring.

However, with these types of constructions, the joining of a ceramic and a metal pose a problem due to their different expansion coefficients. Until now, differences in temperature in industrial environments have irrevocably resulted in rupture. Velterop has solved this problem by using a new joining method for which a worldwide patent has already been applied. He did not wish to elaborate on the subject, but said that the solution lies in inserting multiple transition levels between the porous ceramic and the construction steel. For instance, for one specific transition not thicker than 1 millimeter, as many as five different materials were used.

The ceramic membrane itself is attached to the hollow, porous tube inside the module. It separates a process flow inside the tube and a flow outside the tube along the inner wall of the cylinder. Velterop explains how this works using dehydrogenation, a process essential to the preparation of raw materials for plastics. In this process,

hydrogen is removed from hydrocarbons via a reaction in the ceramic membrane. Hydrogen diffuses through the membrane and the two reaction products end up in the separated process flows. This will enable the chemical industry to drop the currently needed subsequent steps of cryogenic condensation and separation by distillation. As a result, processing costs can be reduced substantially, which makes the use of membrane reactors worthwhile, says Velterop.

Velterop is fully prepared to cope with large-scale applications of his modules. Larger module systems incorporating a 25-square-meter membrane surface per cubic meter module volume have already been designed. For applications in the bulk chemicals industry, he has even developed a new concept with an effective membrane surface which is five times larger.

German Team Develops Corrosion-, Heat-Resistant Steel Alloy

92MI0272 Bonn DIE WELT in German 8 Feb 92 p 20

[Text] A nitrogen steel family will in future protect parts of material subject to heavy stress from corrosion. This opens up lucrative application potential, especially in aviation. Aircraft parts subject to high stresses, such as turbine bearings, are attacked by the salt in the air if they make frequent flights across oceans; the salt eats veritable holes in the aircraft parts. A team of researchers at the Ruhr University in Bochum, headed by Professor Hans Berns, in cooperation with the Essen-based United Forging Works GmbH, has succeeded in developing rustproof, heat-resistant, nitrogen alloy bearing steels. The scientists took advantage of the new technology of pressure electroslag re-melting. This process makes it possible to alloy steels with a relatively high nitrogen content of between 0.3 and 0.5 percent. The mechanical properties of the nitrogen alloys are similar to those of standard steels but, unlike conventional carbon steels, the new steel family presents an outstandingly high resistance to corrosion. When threatened by rust, the nitrogen dissolved in the steel triggers the formation of ammonium ions, which neutralize the acidification of the material as soon as pitting starts. The researchers subjected aircraft turbine bearings made from the new steel to a 200-hour strain test and sprayed them with a salt solution containing chloride ions. No corrosion was found. This also opens up prospects for stainless cold-worked steels in industries where chemically aggressive media are used.

Sweden: Consortia for Advanced Materials Research

92WS0383A Stockholm NY TEKNIK in Swedish
6 Feb 92 p 4

[Article by Anders Wallerius: "Swedish Materials Research Renowned Abroad"—first four paragraphs are NY TEKNIK introduction]

[Text] The quality of Swedish materials research is high.

So said foreign experts who evaluated the concentration on interdisciplinary consortia. Biomaterials research was highly praised: "In an international class," the experts said.

Nutek's [Business and Technology Development Board] long-range emphasis on materials research is built up around a method of organizing research that is quite new in this country; researchers have joined forces in interdisciplinary consortia which have close contacts with both industry and foreign colleagues.

After two years, a group of six professors from the United States, England, Germany and Sweden has now evaluated the program at Nutek's request. They first studied the way research is organized in the consortia: "We are impressed with the quality and planning of the research," the professors said. "The consortia initiative has been very successful and has stimulated research across disciplinary lines."

The following are characteristic of the consortia:

- a strong researcher-led management with scientific and economic responsibility
- direct cooperation between researchers from different disciplines
- representatives from industry in the management groups
- cooperation with colleagues in other countries, including cooperation within the framework of the EC's R&D activity

Consortia are a suitable way to implement long-term research across disciplinary lines, according to the experts.

It can already be shown that the method is successful. And many of the 11 consortia will probably give Swedish industry a shot in the arm.

By and large the consortia can be grouped in four main areas:

- thin film and microscopic structures
- materials with unique properties
- theory and simulation
- surfaces and how they interact

Biomaterials is a good example of a successful consortium; here there is interdisciplinary cooperation, long-term importance for industry, excellent scientific leadership and a coordinated organization.

"The research is of international quality," the analysts said.

"The consortia are a valuable form of funding that give us researchers great freedom to organize ourselves and work across disciplinary lines. Now we can involve those who are needed without having to think of institutional boundaries," said Bengt Kasemo of Chalmers Institute who leads the consortium.

The biomaterials group studies how biological tissue reacts to different materials. The interaction between biomaterials and biological systems is studied from the bottom up. The researchers are trying to discover the individual factors that influence the interaction between living tissues and artificial materials.

But the emphasis on the strategically important consortia assumes that the program will be allowed to continue for a 10-year period as planned. If the budget is cut it will jeopardize the future of the entire effort, the group of experts said in their report.

Originally the consortia were supposed to receive 84 million kronor for the first three-year period (1990-1993). In reality they received 11, 28 and 40 million in the three years.

In the next three-year period (1993-1996) Nutek wants to spend 60 million kronor a year.

After the fifth year the plans call for terminating some consortia while providing others with increased funds.

[Box, p 4]

The 11 Consortia

1. Metals with unique magnetic and mechanical properties are studied in the first consortium.
2. The Angstrom consortium studies processes for the production of thin film, including production from diamonds.
3. The consortium for thin film development looks into different methods and materials for producing semiconductors and microchips.
4. The consortium for nanometer structures develops advanced methods for producing extremely small semiconductor circuits.
5. Oxide deposits on metals and how they react with their surroundings are studied in a separate consortium.
6. The consortium for cluster and ultrafine particles is learning how to produce minute particles whose small size gives them unique properties.
7. The interface layer in polymers is studied in one consortium. Here, research is conducted on the molecular interaction in the interface surfaces between different polymers.
8. The consortium for biomaterials looks into what happens at the point of contact between biological tissue and implant materials.
9. The theoretically based expert system for forming new materials and simulating their properties is being developed in a separate consortium.
10. Another consortium is working on computer-aided development of new metal alloys and processes.

11. Superconductive materials and their basic properties and nature are studied in a consortium.

AEROSPACE

DASA's View of Market for Proposed Regional Aircraft

92P60160 *Duesseldorf HANDELSBLATT in German*
5 Mar 92 p 21

[Text] The Deutsche Aerospace AG (DASA), Munich, sees excellent market chances for the new 80-130 seat regional passenger aircraft which it will develop and build together with Aerospatiale (France) and Alenia (Italy). Market studies have resulted in potential sales of 600 to 800 planes in the next 15 years, said Karl J. Dersch, marketing director of Dasa, recently during the Asian Aerospace aviation exhibition in Singapore. The plane has good chances in Europe, as well as Asia and America, according to him.

"The customers have convinced us that the market needs a really new 80-130 seat aircraft in the coming years," said Dersch.

The airplanes have the working designations DAA 92 and DAA 122.

According to Dersch, preliminary work for the project is going according to schedule. In the next few weeks there will be the planned founding of a program company for the new airplane.

The company, which will be owned 50 percent by Deutsche Aerospace, and 25 percent each by Alenia and Aerospatiale, will be headquartered in Munich. DASA's estimate for the market volume for an 80-130 seat aircraft, 1996-2009: 700 airplanes made by the DAA group, with 43 percent being sold to North America, 32 percent to Europe, and 25 percent to other regions.

The estimated market volume for 80-130 seat aircraft made by other manufacturers is 1400.

DASA's estimate for total sales volume: 58 billion dollars (in 1990 prices).

Of this amount, the DAA would account for 19.3 billion dollars, with 7.1 billion dollars for the DAA 92 and 12.2 billion dollars for the DAA 122. Other manufacturers of this size aircraft would sell 38.7 billion dollars worth, according to this estimate.

Contactless Laser Metrology Used in German-Dutch Wind Tunnel

92MI0264 *Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German* 29 Jan 92 p 6

[Text] Scientists at the German Aerospace Research Institute's (DLR) Goettingen Research Center have successfully used contactless laser technology in field tests on a DLR model helicopter rotor in the German-Dutch

wind tunnel. These measurements are needed to answer questions involved in noise reduction.

For the first time, the three-dimensional speed range has been measured in the immediate vicinity of the rotating blade, using what is known as the laser Doppler anemometer. As no experience in using this laser measuring technique had been acquired anywhere in the world, the DLR scientists were able to obtain satisfactory answers to a number of specific questions only during the measuring program itself.

An important role was played by the extremely precise optical alignment of the up to seven laser beams with an angular precision of one-one-thousandth degree. No less important was the recording of the chronological speed gradient for all three directions in space during the extremely brief 1.5-millisecond passage of a rotor blade.

The measuring technique itself involved the introduction into the current of particles about one micron in size that struck the point of intersection between the laser beams after a 50-meter run. The Doppler-displaced scattered light from the particles was what made it possible to measure the speed.

Italy: ERS-1 Satellite Becomes Operational

92MI0274 *Rome AIR PRESS in Italian* 5 Feb 92 p 228

[Text] Six months after its launch, the ESA's [European Space Agency] first remote sensing satellite, the ERS-1 [European Remote Sensing Satellite] has been declared operational. The announcement was made by the ESA at the end of the testing phase involving instrument calibration tests, sensor calibration, and confirmation of satellite data. The results of these tests were in compliance with, if not superior to, the values set. These activities began early last August (the launch took place on 16 July and involved Alenia Spazio and other Italian industries) and ended in mid-December. The activities involved many earth infrastructures (laser tracking stations, transponders, etc.), and instruments aboard the spacecraft, throughout the world with the support of many European and non-European scientists. An enormous quantity of data was processed during this period, including the LBR [Low Bit Rate], and SAR [Synthetic Aperture Radar] data collected and processed by various ESA institutes and national installations in ESA and non-ESA member countries.

The various activities during this phase included the purely experimental operations that took place on the satellite in the "Roll Tilt Mode" on 11-12 December 1991. The entire platform was made to rotate 10° to 15° on its rolling axis, thus allowing the SAR sensor to function at an angle of 35° instead of the 23° during the nominal operational mode. The results were so interesting that the first week of April will be entirely dedicated to a second cycle of activities in the "Roll Tilt Mode" before starting the "repeat cycle orbit" (a 35-day period) that will last until the end of 1993. Maneuvers in orbit to put the spacecraft into another repeat cycle orbit

(a three-day period), for ice tests began on 13 December 1991. This "ice orbit" was reached on 28 December and will be maintained until next March.

SAR data is transmitted to 16 earth stations, six in Europe and 10 in other parts of the world. The digital and photographic documentation taken from the data has demonstrated the exceptional performance of this instrument and the congruence of algorithms to data processing requirements. The processing chains at the ESA's central station, its station in Norway, and those in the United States and Canada have been declared operational and authorized to distribute material to the PI ([Principal Investigators]—scientists chosen by the ESA through an "announcement of opportunity process") but also to any other interested party. This data is regularly filed at the PAFs [Processing and Archiving Facilities] operating in various ESA countries: I-PAF in Matera for Italy, D-PAF in Oberpfaffenhofen (Munich), and G-PAF (in Farnborough). The distribution of the basic off-line products generated by these infrastructures has already been authorized. The future distribution of thematic and precision products is still pending authorization.

Global LBR data is now routinely transmitted to ESA stations for real-time processing. It is then transferred through the sorting center in Rome from the ESA's ESRIN [European Space Research Institute] facility in Frascati, Italy for inputting into the world meteorological network and ESRIN's earthnet network for the user distribution service. They are then sent to the French PAF (F-PAF) in Brest. Upon request, the needs of users may even be incorporated into mission programs to meet the user requests received by Earthnet.

The worldwide commercial distribution of ERS-1 data and derived products is handled through the ERSC [Eurimage, Radarsat International, and Spot Image Consortium]. Negotiations have now been concluded and the contract has been sent to ERSC for signature. Meanwhile, in Frascati, ESRIN has already started to collect user requests and satisfy clients' needs. For information on the type of products, their availability, and prices, contact the help desk at 06-94180600.

Bavarian Government Takes Stake in German Aerospace

*92MI0291 Bonn DIE WELT in German 13 Feb 92
p 11*

[Text] The Free State of Bavaria's holding in the aerospace concern Deutsche Aerospace AG (DASA), Munich, entails no job guarantees. Nevertheless, Bavarian Finance Minister Georg von Waldenfels has emphasized that the Daimler-Benz subsidiary had promised an "even and fair distribution" of jobs between northern and southern Germany.

If the planned exchange of Bavaria's MBB holding for DASA shares goes according to the wishes of the CSU [Christian Social Union], it will have retroactive effect

from 1 January 1992. It is bound up with the reorganization of the aerospace division of the Daimler-Benz group. The first stage consists in combining Messerschmidt-Boelkow-Blohm GmbH (MBB, Ottobrunn) and Telefunken system GmbH (TST, Ulm) to form DASA, which will have its head office in Ottobrunn. MBB will first be converted into an AG [stock corporation]. The new name of what has to date been Aerospace AG has not yet been decided. As a DASA spokesman explained, the decision of the Bavarian cabinet to convert the Bavarian holding clears the way for this reorganization.

The finance minister said that the Free State's scope for influencing the concern had not been altered by the swap, and that DASA needed to be a large concern that would exploit all the synergies at its disposal. The same applied to military and civil aircraft construction. In the military sector, he continues to back production of the Jaeger-90.

AUTOMOTIVE INDUSTRY

Germany: New Prototype Joins Electric Car Market

*92MI0320 Bonn DIE WELT in German 22 Feb 92
p 25*

[Text] The electrical plug, rather than the gasoline pump, is the way forward, as the BMW E1 and the Volkswagen Chico are showing. However, intelligent approaches to the electric vehicle are not being taken by established automobile manufacturers only. An electric vehicle that matches its competitors for design and performance in every respect has just been presented in Stuttgart. Systems and transport consultant Frederic Vester describes it as "a car for future lifestyles and transport strategies: not only clean, quiet, and small, but also very comfortable, and a car for the status-conscious."

This electric mini measuring 2.70 meters in length and weighing 600 kilos answers to the name of E1 Sport ElectricCar. When used for inner-city travel, where it has the greatest scope for improving traffic conditions and relieving pressure on the environment, it can run for 200 kilometers without "refueling." The E1 Sport takes just five hours to recharge its zinc-bromine battery overnight from the electricity main.

The sponsors and financial backers of the concept are Alfred Ritter and his sister, Marli Hoppe-Ritter, the owners of the Ritter chocolate factory in the Swabian town of Waldenbuch. Compared with the car industry's major design centers, the E1 Sport's birthplace is modest in scale. Electronics engineers, designers, and racing car specialists at the workshop in Ibach took less than two years to develop this urban car for the year 2000. Thomas Albiez, head of the team, states that "four categories: travel to work, shopping, school runs, and leisure, account for over 70 percent of all the mileage

clocked in Germany. Typical distances are between seven and 17 kilometers, which are ideal for electric vehicles."

There is sufficient power to run electric vehicles, according to the Association of German Electricity Companies (VDEW), which estimates that 1 million electric vehicles would use just one-half percent of Germany's electricity output. The power required could moreover be derived mainly from small-scale in-house power stations providing combined heat and power generation, windmills, or solar collectors. Though generating electricity from fuels of German origin does cause pollution, the extraction, processing, and transport of gasoline causes even more. Moreover, electric vehicles are totally nonpolluting and make hardly any noise. "In conjunction with rational transport planning, electric vehicles can help to overcome the noise and paralysis of inner-city traffic chaos," comments Frederic Vester.

In common with its counterparts from VW and BMW, the El Sport is a prototype, although it is hoped that it will go into small-scale production very soon. This may be at the Simson factory in the Thuringian town of Suhl, which until recently produced the GDR's motorcycles. The El Sport will cost around 50,000 German marks [DM] in small-scale production, though the price could fall to around DM30,000 if production runs become larger.

BIOTECHNOLOGY

Commercialization of Hepatitis "A" Vaccine Analyzed

Need Questioned, High Cost Criticized

92WS0347A Paris LE MONDE in French 5 Feb 92
p 20

[Article by Jean-Yves Nau: "Viral Hepatitides: Vaccinate at Whatever Cost"; first paragraph is LE MONDE introduction]

[Text] Vienna—Ten years after the advent of the vaccine against hepatitis B, the vaccine against hepatitis A is to be commercialized. Will its use be necessary?

There is no way to think that chance made an untimely appearance here. Barely a few days following the "leak" concerning the imminent commercialization of the first efficacious vaccine against hepatitis A (LE MONDE, 19 January) by its developer, the multinational pharmaceutical firm SmithKline Beecham [SKB], the firm held a symposium in Vienna devoted to this infectious disease, about which too little is known (1); a scientific seminar, the totally unconcealed purpose of which was to launch this expensive vaccine, the absolute necessity of which it will be hard-pressed to prove to the general public and to health officials, on an international scale.

Identified centuries ago, the "jaundice" epidemics associated with bad hygienic conditions, were only recently linked to a specific infectious agent. In 1969, scientists succeeded in inducing the disease in small monkeys (marmosets) by way of human fecal matter and, in 1973, a team led by Robert H. Purcell (American Health Institute) announced in SCIENCE magazine the detection, by means of electron microscopy, of a virus that later proved to be the causative agent of the disease. It is a "small" (27 nanometers in diameter) virus of the RNA type, devoid of envelope, and classified as belonging to the family of picornaviruses. Far removed in its structure from the hepatitis B virus [HBV] (a larger virus, of the DNA type, with envelope), the hepatitis A virus [HAV] is capable of infecting humans and some species of monkeys, and is at the origin of very different infectious and physiopathologic phenomena.

While hepatitis B is a disease that is transmitted through blood or sexual contact, and that is often severe, sometimes fatal, and frequently can become chronic, hepatitis A is generally represented as a not-severe "jaundice," often water- and food-borne (ingestion of shellfish is traditionally mentioned), and without consequences. The reality concerning this ailment is actually somewhat more complex. First of all, because contamination by the hepatitis A virus—considering especially its so-called fecal-oral mode of transmission—appears to be closely tied to the population's general hygienic conditions. And secondly, because while it is true that the infection is usually not severe (in the majority of cases it even goes unrecognized), its morbidity can nevertheless not be neglected, nor in some cases its mortality, a risk that becomes greater when infection occurs later in life (2).

Progress Owing to Sewer Systems

On this point, the situation is improving in most of the industrialized countries. Numerous epidemiological studies presented in Vienna showed a progressive but sizable decrease in the proportion of persons having come in contact with the virus during the past few years. This is one of the most perfect examples of the biological benefits deriving from the improvement in general hygienic conditions after the World War II, owing markedly to the widespread installation of sewer systems.

In the United States, the latest studies (C. Schapiro, Center for Infectious Diseases, Atlanta) place the number of hepatitis A cases in 1990 at 12.6 per 100,000 inhabitants. In that country the most important foci of infection are in the mountainous states as well as in Indian and Hispanic environments. The risk factors most frequently found there, when they can be identified, are exposure to an infected person (26 percent), use of injectable drugs (16 percent), recent international trips (4 percent), and ingestion of contaminated water or food (3 percent). The proportion of persons in the U.S. found to have anti-virus A antibodies, proof of a previous contact with the virus, increases from 10.9 percent at 25 years of age to 73.6 percent in persons over 50. It

averages 38.2 percent among whites, 49.9 percent among blacks, and as high as 61.6 percent among Americans of Hispanic origin.

In France quantified findings tend to indicate a rapid decrease in the prevalence of anti-virus A antibodies among the young. The phenomenon is particularly evident among military personnel, as shown in a recent study published in the 15 July 1991, *BULLETIN EPI-DEMIOLOGIQUE HEBDOMADAIRE* (3). Another original study touching on the same subject, carried out in 1991 among 5,500 persons living in 10 west-central departments of France (Dr. Frederic Dubois, of the Regional Health Institute at Bretonneau CHU [University Hospital Center], Tours), yielded absolutely matching results with respect to the differences observed as functions of socioeconomic criteria, and with respect to the potential risks stemming from the disappearance of immunity in the under-40 population as a whole. These observations support the conclusion that by the start of the 21st century, if the observed present trend continues, the large majority of the French population will no longer be protected against this virus, as a result of not having been exposed to it during their youth.

Elsewhere, the situation may be totally different, as in Shanghai where, in 1988—Dr. Zhiyi Xu (Shanghai University of Medicine) recalled in Vienna—an epidemic that started with the ingestion of contaminated shellfish produced 300,000 cases of hepatitis A in the space of two months. This phenomenon has its parallel in observations made by health officials of industrialized countries (particularly Sweden, Norway, and the United States) with respect to their military personnel assigned to duty in countries where the risk of contamination is markedly higher. In a more general way, many studies show that persons who live in industrialized countries and travel abroad more or less frequently (business executives, tourists, military personnel, and hitchhikers) are exposed to a greater risk. To such an extent that specialists in preventive medicine and interested professionals in the pharmaceutical industry are in agreement that these persons comprise the first target group for vaccination against HAV.

Long ago announced as imminent, that vaccine is now, as of but a few weeks ago, an industrial and commercial reality. Fifteen years after the first human testing of the vaccine against hepatitis A (Professor Philippe Maupas, CHU Tours), the vaccine against hepatitis B could not be developed until success was finally achieved in culturing the virus *in vivo*. [preceding passages as published]. The virus subsequently had to be "inactivated." The vaccine is available for intramuscular administration in three separate injections. According to SmithKline Beecham officials who have conducted studies on 26,000 volunteers in 18 countries, the protection it provides is of very good quality (antibodies appear in 99.8 percent of the cases after the second injection). Switzerland has just authorized the marketing of this vaccine, and patent applications have been filed in France and in many other countries (Belgium, Great Britain, Germany, Italy, Spain etc.). Several authorizations are expected

in the next few months. The U.S.-based firm Merck Sharp and Dhome is preparing to launch an equivalent vaccine on the market. France's Pasteur-Merieux Serums et Vaccines company lags behind its two competitors by some three years in this domain, a fact that, clearly, will make it very difficult for French health officials to adopt a protectionist position.

The imminent commercialization of this vaccine faces difficulties in two respects. The first concerns the price, which, it is pointed out, will exceed 150 francs[Fr] per dose, bringing the total cost of the vaccination to approximately Fr500. "We invested nearly \$100 million in the research and development of this vaccine, and for the moment, its production is still limited to one or two million doses a year. We want to recover our investment as soon as possible," says Dr Francis Andre (SKB). "Therefore we shall not lower the price until competition compels us to."

The other difficulty concerns the defining of target groups to whom the vaccination could reasonably be made available, it being understood that the objective of eradicating hepatitis A, while theoretically feasible, appears totally illusory in practice. A consensus seems to have emerged here in favor of vaccinating collectives of children suffering from malformations or psychiatric abnormalities. The new vaccine should also be of interest to military medicine as well as firms whose employees have to travel frequently to underdeveloped countries. Aside from these all-in-all quite limited groups, it is not clear yet who else might be directly interested in this expensive vaccine. Fully aware of this problem, industrialists are already working on the next stage, looking toward the offering of a single vaccination against both viral hepatitis A and B. Reliable sources say that the World Health Organization, for its part, is preparing to add anti-hepatitis B vaccine (4) through their vaccination program which recommends administering to all the young children of the world.

Footnotes

(1) "Active Immunization Against Hepatitis A. Vienna, 27-29 January 1992." This meeting was sponsored by the SmithKline Beecham group. This group is the result of the 1989 merger of two firms: Beecham, and SmithKline and French. The vaccine against hepatitis A was developed by the former Belgian company RIT, which was taken over in 1968 by SmithKline and French.

(2) Average incubation period of the disease is estimated to be about 30 days. In adults, the disease may be limited to jaundice associated with fatigue and diverse clinical and biological symptoms. Fatal cases of hepatitis A among the elderly have been reported.

(3) "Decreased Prevalence of Anti-HAV Antibodies Among 20-Year-Old Military Personnel." *BULLETIN EPI-DEMIOLOGIQUE HEBDOMADAIRE* No 28, 1991. This article is signed by a group of specialists of the

Clamart Armed Forces Blood Transfusion Center and the Paris Val-de-Grace Hospital.

(4) In spite of recommendations made by the several interested agencies, the government has not yet reached the decision, announced a year ago, to make screening for hepatitis B available to pregnant women. If this screening were made systematic, the approximately 12,000 children who are born every year to infected mothers could benefit from preventive measures (injection of gamma globulins in association with the vaccination).

Merits Questioned

92WS0347B Paris *LE MONDE* in French 5 Feb 92
p 20

[Article by Jean-Yves Nau: "The Ransom Price of Hygiene"]

[Text] Besides its strict medical and preventive dimension, the forthcoming commercialization of a vaccine against hepatitis A further radicalizes the present development of the battle against infectious diseases. Today, it is no longer a matter of offering vaccines to protect against serious or fatal diseases (smallpox, diphtheria, tetanus, poliomyelitis, whooping cough, tuberculosis, hepatitis B, and yellow fever), but rather of active immunizations against pathologies viewed a short time ago as simple incidents more or less tied to chance. It follows that it is no longer a question of imposing these new vaccines, but rather of the manufacturers having to define "target groups" and vaunt the merits of their products to the groups' members, particularly through the medical profession.

Particularly enlightening, in this regard, was the Vienna symposium, witness, as it was, of the general embarrassment caused when the question was addressed straightforwardly as to the exact indications for this new vaccine, which, on the other hand, has proven its efficacy.

This question can only be addressed in the light of economic data. The population to be vaccinated, not well known though it is but a priori not being a large one, the unit cost per dose appears very high (in excess of 150 francs[Fr]), and without a doubt dissuasive. It then becomes necessary for the manufacturers to try to convince health officials of the utility of such protection in certain children's collectives, or the managements of firms whose staffs are obliged to travel in countries where the risk of infection is high.

This argument will be all the easier to support, more from an economic point of view than from a medical one, in that the epidemiology expounded here demonstrates the extent to which a deep chasm can separate the underdeveloped from the industrialized countries, indeed between the haves and have nots of the latter. In effect, it is as if the general improvement of hygienic conditions that removes early and generally benign contact with the hepatitis A virus, raises in turn the question of preventive vaccination, absent the immunization that

yesterday was naturally acquired, and given the increased incidence of symptoms of the ailment with advancing age.

The instituting of this vaccination at a point in time will then compel follow-up surveillance of the state of immunity of the people previously vaccinated and, if necessary, the administering of boosters, failing which the problem will merely have been shifted if not created anew. On the other hand this problem is not in the least specific to hepatitis A. It poses itself in one form or another in the case of all new vaccines against ailments, protection against which can possibly be viewed as being in the category of personal comfort and not of general interest.

This points up the need to give the utmost careful thought to the "all vaccination" approach, and, to an even greater extent, to the balance the human species must bring to its relations and dealings with the principal pathogenic microorganisms whose eradication, unlike the very fortunate case of smallpox, will in all likelihood prove impossible to achieve by way of vaccination.

COMPUTERS

Inmos, Pereheliion Develop Transputer-Based CAD Station

92P60162 Berlin *MIKROPROZESSORTECHNIK*
in German Feb 92 p 42

[Text] For designers and users of transputer systems, the [British] firms Inmos and Pereheliion Software have jointly developed a scalable CAD station based upon several transputers. Inmos is using the new CAD station at its R&D center in Bristol in a design environment for next-generation VLSI [very large scale integration] components. The hardware and software development modules will also be offered to other manufacturers and users of transputer systems, such as NFS [network file system] file servers, raster image document processors, database enhancers and transaction processing systems. The CAD environment is comprised of components having Inmos iq-System transputer module (TRAM) architecture and can contain any number of T4xx and/or T8xx transputers, all functioning under the decentralized Helios operating system. The environment has a complete X-windows-X11R4 color display with a Motif graphics user interface, local X-clients and applications for systems management. Joint operation with other components of the CAD environment, including important UNIX applications, is supported by implementation of the transmission control and Internet protocols (TCP/IP) over Ethernet links.

Germany: Use of Supercomputers for Research*92WS0395A Berlin ING DIGEST in German Mar 92
p 31*

[Article by Dr. Siegfried Muench: "World Record with Parallel Computers"]

[Text] The balance sheet after six months work on two GMD supercomputers: Parallel computers offer a multitude of future-oriented possibilities in research and applications.

In the Society for Mathematics and Data Processing mbH [GMD], computer specialists had the opportunity of working with the new parallel computers Connection Machine CM-2 and Alliant-FX2816. The GMD, the governmental major research installation for information science and technology, makes these parallel computers available mostly to the Maximum Performance Computer Center. This center was established in 1987 by German Electron Synchrotron [DESY], the Juelich Research Center [KFA], and the Society for Mathematics and Data Processing.

The Connection Machine CM-2 consists of a net with 16,384 individual processors connected with each other in the form of a nine-dimensional hypercube. As a more powerful representative of the SIMD [single instruction multiple data] supercomputer, (which is to say, a single command for many operands), the CM-2 is particularly well suited for high-dimensional problems of massive-parallel applications and can be included in the performance class of the Cray-YMP 8/832.

Just a few months after the CM-2 was installed, researchers at the Maximum Performance Computer Center had registered their first successes with large simulations. Thus, for example, Dr. Gregory Kohring of the Juelich Maximum Performance Computer Center and Cologne University, developed algorithms and used new methods to simulate the behavior of liquids, so-called automatic cellular machines, which permitted the handling of larger systems with greater speed than had been possible theretofore on conventional supercomputers.

The first problem solved by Dr. Kohring was the development of an efficient algorithm to implement the automatic cellular machine on the CM-2. The algorithm permitted greater speeds to be achieved on the Connection Machine than on a processor of the Cray-YMP, and, by means of efficient storage utilization, also permitted four times as many particles to be examined at the same time. In both cases in this comparison, world speed records were set for these applications: 270 million operations per second on the CM-2 with 16k-processors. The other parallel computer in the GMD, the Alliant-FX2816 with 16 Intel/860-processors, also performed well in swiftly handling scientific projects requiring considerable computer time. At the same time, much valuable experience in programming parallel computers was won.

Parallel computers, like the CM-2 and Alliant, in which greater computer performance is achieved through the simultaneous use of many processors, have increasingly gained in importance in recent months, since, owing to physical limits, like the speed of light and quantum effects, any individual processor has a limit set for the maximum switching speed. It will only be by means of massive parallel systems that a computer performance of a thousand trillion operations per second (teraflops) will be achieved.

DEFENSE R&D**Italy: Government Holdings Set Up Defense Hub***92MI0293 Milan L'INDIPENDENTE in Italian
13 Feb 92 p 16*

[Article by Susanna Petrini: "A Public Hub for the Defense Industry"]

[Text] A defense pole has been established: EFIM [Manufacturing Industry Holding and Financial Company] has created a new holding company called Systems and Space, that will oversee all the electronic systems activities of the group. The next goal of the program by state-controlled enterprises to streamline production in the defense industry will be an agreement with the corresponding IRI-Finmeccanica [Institute for the Reconstruction of Industry-Mechanical Engineering Finance Corporation] companies: Fiar and Alenia.

Following the establishment of the railroad pole, the state-controlled enterprises are now launching a new project that is designed to create increasingly closer working relations between Finmeccanica and EFIM. "The possible forms of collaboration are open to discussion," explained Roberto Savasta, a Liberal party representative on EFIM's executive committee, "but an accord has not been reached." However, there seem to be two possible roads to follow: The more flexible course of action calls for the formation of a subholding that would group the commercial and R&D divisions of Finmeccanica and EFIM and the more demanding involves an exchange of shares between the two partners.

Pending the signing of the new pact with IRI, EFIM has launched "its own" so-called defense pole. Four companies will be part of Systems and Space: two from the Agusta group and two from the Ernesto Breda Financial Holding Company. They are Omi and Agusta Sistemi, involved in the area of electronic systems, SMA, specialized in the field of naval and air signaling systems, and Galileo, which operates in the sectors of missile avionics, space instrumentation, monitoring environmental pollution, and industrial automation. "These four companies," explained Savasta, "which were transferred to the new holding, will maintain project autonomy while adhering, however, to a precise company structure."

With this system, EFIM aims to concentrate and streamline its own activities on the electronics front, while

avoiding, above all, the squandering of energy in the area of investments. EFIM's programs to streamline the defense sector also include the establishment of a new missile company, Obm, that will have the majority shareholding in Oto and is open to participation by Italian and foreign partners.

In addition to company reorganization activities, EFIM has drawn up a new industrial strategy that calls for a greater involvement in international consortia and diversification. This involves shifting production and research objectives to those market areas in which products also have civil applications.

ENERGY, ENVIRONMENT

EC's Environment Action Program Introduced

92BR0181 Antwerp DE FINANCIËL-
EKONOMISCHE TIJD in Dutch 7 Jan 92 p 18

[Article: "Fifth Environment Action Program To Go Beyond Legislation: European Commission Favors Including Cost of Environmental Effects in Price of Product"]

[Text] Amsterdam—The cost of the damage a product causes the environment must be included in its price. Manufacturers will not only be responsible for the environmental effects of their product from the moment it leaves the factory, but all the way through the waste stage. This is one of the main objectives of the European Commission's fifth environment action program, which will be published soon.

The action program, "Towards Durability," which is to be discussed by the European Commission next month, offers a framework which requires the participation of politicians, managers, and citizens. The program must see to it that "the present generation passes the environment onto the next generation in such a sound condition that prosperity and welfare can be maintained on a high level." In its action program, the Commission argues that the measures taken over the past 20 years on a European level have proven inadequate in solving the present environmental problems. The new policy aims at preserving the quality of air, water, and soil, at managing the urban and coastal areas, and at handling the waste problem.

The proposed program states that legislation alone will not allow the objectives to be reached. In order to force industry to behave responsibly, new instruments are required, such as the above-mentioned recalculation of the cost price and a greater responsibility for the manufacturer.

In addition, the Commission is contemplating an environment fund which could be used by poorer member states to finance environmental measures. The patterns of behavior and consumption could be changed by more instruction and training and by a wider dissemination of information. The Commission is also considering the

possibility of rewarding environment-friendly behavior, e.g., by granting financial benefits.

The European Commission wants to work out special action programs for five sectors. These sectors, which constitute a heavy load on the environment, are: industry, energy, transportation, agriculture, and tourism. According to the Commission, measures taken at the Community level are the most effective for these sectors.

In order to see to the implementation of the action program, the Commission recommends that a European network of environment inspectors be set up. In addition, a consultative committee, consisting of representatives from the companies, consumers, interest groups, and authorities, as well as a political committee made up of members of the European Commission and high-ranking officials of the Community's member states should coordinate the European environmental policy.

After the discussion of the action program in the Commission next month, the European Council of Ministers must still approve the action program. Because pollution does not stop at the borders of the European Community, the Commission will urge, at the world environment conference UNCED to be held in Brazil this summer, that a charter establishing the rights and obligations with regard to environment and development be adopted and that a corresponding worldwide action program be worked out.

Germany: Development of Wind, Solar Energy

Wind Energy Technology

92WS0292A Duesseldorf WIRTSCHAFTSWOCHE
in German 10 Jan 92 pp 54, 59

[Article by Burkhard Boendel under the rubric "Special High-Tech": "Wind Power: the Return of the Titans; Paddle Fan in the Antarctic"; first paragraph is an introduction]

[Text] Power generation by means of modern windmills is starting to become lucrative. A new system is pushing costs down still further.

A strong breeze is sweeping over the Kaiser Wilhelm Polder. The wind blows over the dike on the west coast of Schleswig-Holstein at a speed of greater than six meters per second on a yearly average. While it becomes slightly unpleasant for the visitor with this weather situation, the strong breeze is just what the numerous wind power stations (WKAs) standing there want: "An ideal place," says Stephan Glocker, technical director of Windtest Kaiser-Wilhelm-Koog [Kaiser Wilhelm Polder] GmbH [Limited Liability Company], as he extols the windy area. The extensive wind farm on the polder, whose mills have a peak power of 12.5 MW, will probably remain a unique item. Since then, additional

stations of so large a size are encountering resistance from conservationists that have specialized in the preservation of the bird world.

The industry's reaction came promptly. If there will be fewer locations for reasons of protecting the birds, the locations will have to be utilized simply more intensively: Then the wind power stations will have to work with higher power. Though the ambitious Growian idea came to nothing at the beginning of the 80s, stations having the same power—three megawatts—are already being built again. Aeolus II, which was constructed jointly by MBB Energie-und Industrietechnik [Energy and Industrial Equipment] of Munich and its Swedish partner Kvaerner Turbin AB [Turbine, Inc.], went into operation in Wilhelmshaven in the middle of the year.

The publicly sponsored project cost around 25 million German marks [DM]. The dimensions of the new giant are impressive. The hub rotates at a height of 92 meters and the two-bladed rotor has a diameter of 80 meters. MBB expects that Aeolus II will generate 7.3 gigawatt-hours of electricity per year. The colossus weighs a magnificent 1410 tons. The rotor blades alone turn the scales at nine tons each. The blades were made of glass- and carbon-fiber-reinforced plastics.

MBB engineers conducted a tough load test on the blades at the end of last year: They heaved a load of 30 tons onto a horizontally fixed blade. The strongest squalls load the blade with 23 tons at the most. The blade deflected by three meters as it groaned. Now the rotor can be installed.

In addition to the large-scale stations—aside from MBB, MAN Technologie AG [Technology German Stock Corporation] in Munich has been busy with the 1.2-MW-powerful WKA 60, that has been covering a part of the electricity demand on Helgoland for a half year—a new wind exploitation idea is creating a sensation. The H rotor by Heidelberg Motor GmbH in Starnberg is no longer installed horizontally on the tower but sits on top of it and rotates like a paddle fan about its vertical axis.

"We have only one moving part, namely the rotor," Goetz Heidelberg says as he names his technology's plus. The rotor of the traveling-field generator for electricity generation is on the rotating axle. The vertical blades, which are not adjustable, rotate depending on which direction the wind is blowing from.

The machine still supplies electricity even under extreme conditions. This type alone was considered for the German Georg von Neumayer Antarctic Station, because no gear lubrication functions any longer at temperatures of down to -55° C.

Goetz Heidelberg hopes to be able to build larger stations less expensively too. He is hoping for an investment of DM3000 per kilowatt of installed power. By comparison, Aeolus & Co. has to calculate at three times

as much. The first H rotor tuned to 1.2-megawatt will show sometime this year whether Heidelberg's forecast will prove correct.

Then the current wind exploitation boom could absolutely explode. "Europe is catching up tremendously now," thinks wind expert Erich Hau, chief executive of Energietechnische Analysen [Power Engineering Analyses] GmbH in Munich. Of the 20,000 power-generating windmills in the world, 16,000 are just in the wind power mecca of California. Denmark, as the European trail-blazer, comes to a figure of 3000. If the trend continues as up till now, before long there will be 2000 windmills also in this country according to a forecast by Joachim Behnke of the German Society for Wind Power in Hannover.

If Research Minister Heinz Riesenhuber raises his sponsorship program once more, it could easily become still more. He has at his disposal funds for the development of 250-MW wind power as matters stand. However, the demand is far higher, the experts at Juelich Research Center know, who watch over allocation of the money. Over 3000 applicants are registered there, who want to operate wind stations of this sort—much to the delight of manufacturers like Enercon, Husumer Schiffswerft [Husum Shipyards], Micon, MAN and MBB. "At present, orders have been submitted for an installed power of more than 1000 megawatts," Hans R. Ruehmann, product area head at MBB Energie-und Industrietechnik in Delmenhorst, reports from the industry.

According to a rough calculation, windmills having this power would produce around 600 million kilowatt-hours per year, around 1.5 percent of Western German electricity consumption in the year 1990.

Wind exploitation's progress was triggered not only by Riesenhuber's sponsorship, even though the investment aid of up to 40 percent of the total cost and six pfennigs for each kilowatt-hour that is fed into the network are already easing the first step. The redrafting of the power supply legislation in the beginning of 1991 was at least just as important. According to it the electricity supply companies will have to reimburse 16.5 pfennigs per kilowatt-hour. Then wind power will be a profitable business at good locations.

A thousand megawatts, the advocates of wind power calculate, still do not have to mark the end of the flagpole. "We could guarantee up to 10 percent of the local electricity supply from wind power," MBB engineer Ruehmann is certain of.

Solar Energy in Houses

92WS0292B Duesseldorf WIRTSCHAFTSWOCHES
in German 10 Jan 92 pp 59-61

[Article by Ulf J. Froitzheim under the rubric "Special High-Tech; Alternative Forms of Energy": "Photovoltaics: Less Expensive Solar Cells in the Offing; Electricity from the Roof"; first paragraph is an introduction]

[Text] Houses whose electricity and heating demands are covered by sunlight are no longer utopia today.

Professor Adolf Goetzberger sees menacingly dark clouds moving out from the direction of Bonn. All the same they can no longer destroy for him the fruits of his many years of research work, because the Freiburg scientist has just in time secured himself and his team a place in the sun. In the coming fall the head of the Fraunhofer Institute for Solar Energy Systems is finally to prove after a construction period of one year that a family can live quite comfortably even without an electricity hookup and boiler room even in the rather inhospitable climate of Central Europe.

Goetzberger and his colleagues are working on a minor sensation, the first 100 percent energy-self-sufficient solar dwelling in Germany. The Federal Research Ministry, Fraunhofer Society, land government, city and industrial partner have reached so deeply into their pockets in order to construct the Freiburg model home with its modest 100 square meters of living space that it would have been enough even for the purchase of a villa at Lake Starnberg, for example. The conventional construction costs are estimated at DM600,000. The exotic energy equipment requires an additional DM800,000. All the same it was not at all a question of an economic solution for Goetzberger and his project leader Wilhelm Stahl, whereby the investment would pay for itself after a couple of years. From the beginning the object was the maximum solution, the absolute non plus ultra of energy saving.

Photovoltaics, that is the direct conversion of sunlight into electricity—in addition to extremely efficient thermal insulation and heat recovery—plays the central role in the energy-self-sufficient Freiburg house. In order for the sun's rays to be enough in both the summer and winter and to cover the occupant's energy requirement, the Baden cottage builders distribute over the roof, in addition to new types of flat collectors having transparent thermal insulation for domestic hot water heating, around 42 square meters of photovoltaic solar generators having a peak output of 4.5 kilowatts. The excess electricity that is left over on fair days is stored in the house.

No electrical cable connects the building to the public power system. In its place lead storage batteries having a storage capacity of 21.6 kilowatt-hours see to it that the refrigerator does not defrost at night, the occupant can see the TV news and the bedside table lamps do not go out. In order to get through longer periods of time with little sunshine, the energy-self-sufficient solar house contains a storage system with hydrogen and oxygen that an electrolyzer produces from water by means of the surplus photovoltaically produced electricity. Both gases are stored in single tanks. Fuel cells reverse the decomposition process and release the electricity again when required. Only pure water forms when this happens.

The solar hydrogen is also suited for cooking. The two gases are combined into water by means of a catalyst in

a special furnace. Temperatures of around 200°C originate in the process—just enough for cooking. The not yet commercially perfected hydrogen-oxygen system swallows up the lion's share of the cost of supplying power.

That solar generators in their usual type of construction often cannot be brought into satisfactory esthetic harmony with the architecture of a building bothered the specialists of the Cologne Flachglas Solartechnik GmbH [Plate Glass Solar Equipment Limited Liability Company] (Flagsol) company. In order to avoid the impression of a disagreeable alien element, they integrate the solar modules into glass facade elements.

Flagsol found its pilot customer in Stawag Stadtwerke Aachen AG [Stawag Municipal Works Aachen German Stock Company], whose southern facade missed an attractive face when the heating system of its five-story office building was being rehabilitated. The Aachen electricity supplier expects 3200 kilowatt-hours of electricity per year to be produced from the 37 square meters of polycrystalline silicon—with a total cost of the plant of DM300,000.

Although solar cell systems are far from being economical—a system having maximum power of one kilowatt supplies just 3000 kilowatt-hours annually and nevertheless costs as a rule barely less than DM27,000—it is beginning to show that a lucrative market for photovoltaic products is coming into being.

Solar-generated electricity has good opportunities above all in the Third World and in system-remote areas of industrialized countries, for the supplying of telecommunications systems and mountain huts, for example. Photovoltaic systems are often less expensive than it is to lay an electrical cable. In addition there is the so-called 1000-roofs program, where 2250 private building owners can get up to 75 percent subsidies from the federal government and federal lands for their solar roofs.

There are already enough suppliers. In Germany alone Siemens AG, the largest producer of solar cells in the world, Telefunken Systemtechnik [Systems Engineering] GmbH (a DASA subsidiary), Nukem GmbH and Phototronics Solartechnik [Solar Engineering] GmbH, a joint subsidiary of MBB and French multinational oil company Total, are producing various types of solar cells. The capacity of the German factories as a whole comes to around 10 megawatts per year. At present Siemens is building a large-scale plant for 25 megawatts in Wackersdorf.

Recently, the Texas Instruments, Inc. (TI) electronics firms in the American oil metropolis of Dallas surprised the technical world with a new kind of manufacturing process that could help photovoltaics to achieve substantially greater profitability. So-called metallurgical silicon that can be had inexpensively in large quantities suffices

in the TI method instead of the expensive high-purity silicon from the sawing and production waste of semiconductor fabrication.

The Texans' trick consists in forming tiny beads, each of which represents a solar cell. Thousands of these are combined into modules. The electrical efficiency of these cells, the developers state, is to be a splendid 10 percent. Besides, production per watt-peak (power in watts at maximum solar irradiation), according to TI, costs only \$1.50 versus \$8 to \$15 for high-purity silicon.

Pilot-plant-scale production is forming in Dallas at present. And by the end of the year the American industry outsider in cooperation with the Southern California Edison electricity supplier will have gained enough experience to decide on large-scale production.

In Germany, only Siemens and Phototronics are concentrating on amorphous silicon, that most importantly can be transformed into solar cells at a more reasonable price than the crystalline versions. This advantage, it is true, has to be bought at the expense of a moderate current yield. While industrially fabricated, crystalline silicon cells today convert up to 16 percent of the sunlight into electricity, even seven percent counts as respectable for their amorphous relatives.

Which technology will prevail in which markets has indeed become almost a secondary consideration for photovoltaics promoter Walter Sandtner of BMFT [Federal Ministry of Research and Technology]. Already more applications for participation in the 1000-roofs program have been submitted from several federal lands than the land quotas permit. "When the interest becomes still greater," the man from Bonn points out, "it could definitely be that we will increase the program yet again."

Communal Solar Energy Examined

92WS0292C Duesseldorf WIRTSCHAFTSWOCHE
in German 10 Jan 92 pp 62-63

[Article by Rainer Praetorius under the rubric "Solar Engineering": "Shining Proposition; Solar Central Heating From Large Collector Arrays to Supply Entire Housing Developments"]

[Text] When the Bielefeld garbagemen stand under the shower when the day's work is over, they enjoy the pleasant warmth of the water without having pangs of conscience about harm to the environment through carbon dioxide or other emissions of noxious substances. The shower water for the 150 "Mr. Cleans" of the municipal sanitation department does not come from an oil-fired or electric boiler but from environmentally acceptable solar collectors. The Bielefelders tap 56,000 kilowatt-hours per year from the sun. In the process the environment is spared up to 500 tons of carbon dioxide. All the collectors installed in Germany today together prevent the discharge

of over 45,000 tons of the gas that forms when fossil fuels are burned and is partly responsible for the greenhouse effect.

It is always worthwhile to set up solar collectors in order to keep the environment clean. However, from a sheer economical standpoint only in some application niches are they the equal to less expensive oil, gas and night current in providing hot water. Meanwhile, the sun has won the competition with fossil fuels at 120 of the approximately 3000 communal swimming pools in the Federal Republic of Germany. The reason—Simple collectors, hardly more than black hoses lying in the sun, are perfectly sufficient to bring the pool water to a moderate temperature. Such systems can already be had for DM150 per square meter of collector area.

The approximately 10 times as expensive vacuum collectors are at the other end of the power spectrum. Greater expense is lavished on them for the best possible accomplishment of the task of capturing as much energy as possible and of transferring it without loss to the fluid circulating in the collectors.

The absorber is the core of a solar heat accumulator. In standard collectors it is a metal plate having a black coating that picks up a lot of sunlight, but unfortunately also gives heat back to the environment, be it by way of radiation or convection. In vacuum collectors the absorber is in a pump-evacuated glass envelope. This reduces quite decidedly the loss of energy, because now heat can no longer be carried away by means of circulating air. The manufacturer promises up to 30 percent higher power output as compared with the normally thermally insulated collectors. However, this gain has to be paid for: The buyer has to spend from DM900 to DM1400 per square meter. They are from six to 10 times more expensive than the simple garden hose models. However, they have maximum output of 500 watts per square meter.

The solar collector becomes altogether a sheer toy when it is to be used to heat rooms also. "There will hardly be any economical application possibilities even in the future for solar collectors for room heating," the German Institute for Economic Research (DIW) decided in a study for the Federal Research Ministry. It is logical. Most of the heat for heating purposes is generated when it is not needed—on hot days.

However, the picture could be different for solar-supported central heating systems, the Berlin institute judges in its study: "Because surprisingly low costs are expected for these systems, markets should soon open for them, which could lead to high output figures for collectors with a corresponding decline of marginal unit cost."

Solar central heating is the label for the idea of centrally supplying entire housing developments with solar energy by means of large collector arrays. The heat accumulator plays an important role in this new idea for Germany. It has to pick up the supply of solar radiation that varies daily and over the longer term and keep it ready for consumption at other times. The heat accumulator is a

weak point in many renewable energy systems—according to the motto, “Go under the shower now, the water has been heated up.”

The accumulator often does not hold out long enough with the customary capacity of 0.3 cubic meters maximum in single-family houses. It looks more promising with the large accumulators of a solar central heating system, that can store up to 20,000 cubic meters of hot water. Because the tank volume to tank surface ratio is greater here, the temperature of the contents drops substantially more slowly.

The Federal Research Ministry would also like precise information concerning the feasibility and economic efficiency of such a solar-supported central heat supply system. It put the Institute for Thermodynamics and Heat Engineering (ITW) of Stuttgart University in charge of a study within whose scope preliminary studies were made for planned new construction sites which have from 100 to 500 housing units at several locations. The Stuttgart researchers came to the conclusion that this system has in the field of heating “the greatest technical potential among renewable energy sources in Germany.”

The next two years have been designated for a test of the system components in practice. The choice of the location for the pilot project fell on Ravensburg northeast of Friedrichshafen. In the future solar energy will heat 29 single-family row houses there from a collector array 120 square meters in size. ITW figures on a cost of DM95,000 for the total solar system including the accumulator having a total capacity of six cubic meters and the distribution system. In this case this system is approximately just as expensive as the installation of natural gas boilers.

According to ITW's estimate only a meager 10 percent of the technically possible potential of solar central heating will be exploited in Germany by the year 2005. “As compared with Sweden, which has done research in this field since as early as the beginning of the 80s, Germany is at least five years behind in application and technology,” complains Michael Nast, expert in low-temperature heat at the German Aerospace Research Institute (DLR) in Stuttgart. Our Scandinavian neighbors gained their first place to boot with only one-tenth of Germany's research funds for renewable energy sources.

Bayer Developing Polyurethane Recycling Process
92WS0376D *Paris COMPOSITES ET NOUVEAUX MATERIAUX* in French 26 Feb 92 p 9

[Article: “Bayer AG: Recycling of Retiform Polyurethanes”]

[Text] The German plastic materials producer Bayer AG is currently working on a process to recycle retiform

polyurethanes; up to now, it was thought impossible to transform retiform plastics by applying heat because of their infusible character.

The process developed by Bayer operates under high pressure at temperatures of about 180°C. The base materials (production waste, defective parts, body elements) are first ground into granules. Then, after being preheated, they are introduced into the hot compression mold. During compression molding, the granules agglomerate but without plasticizing. The process falls somewhere between fusing and sintering.

Though there is some loss of quality in the articles obtained, they retain 50 percent of the tensile strength and about 15 percent of the stretching properties of the original parts. However, Bayer believes there are already enough applications for this process to make it economically and ecologically valuable. The automobile industry should be among those to find it of greatest interest, since the recycled parts are adequate for the lining of wheel housings and battery covers or for the trim on chassis elements.

Information: Bayer AG, Leverkusen, (0214) 30-31162.

Germany: Fiber-Reinforced Pistons To Reduce Diesel Pollution

92WS0395B *Stuttgart BILD DER WISSENSCHAFT* in German Mar 92 pp 38-41

[Article by Richard Sietmann: “Fibers in the Engine”]

[Text] New-type pistons reduce engine exhaust. Two German companies are the first producers of fiber-reinforced automobile pistons. Engine pollutants are reduced to a minimum.

“Something new for the world and ready for production,” enthused Wolfgang Henning of Kolbenschmidt AG for a development that was awarded the VDI Society for Materials Technology “Prize for Innovative Materials-Applications 1991.” The fiber-reinforced pistons for vehicle diesel engines, developed by the Neckarsulm enterprise and also later by the Mahle piston manufacturer in Stuttgart, represent the first structural part of a new generation of metals, now entering the mass production stage. This new development will shift the war against environmental pollution away from the exhaust fumes to their source—the combustion chamber. Soot particles, which do not even occur when combustion is complete and thorough, do not even have to be trapped by soot filters in the exhaust stream.

The first step toward complete combustion is by way of a better vortexing of the fuel-air mixture. The solution to this problem lies in the geometry of the piston. Instead of an even piston surface, the designers deliberately introduced a depression. The second step required a true piece of high technology however. The depression causes the ignition pressure and the combustion temperature to rise, thereby reducing the amount of unburnt residue.

However, conventional piston alloys are not suitable because pistons made of cast iron and steel cannot withstand the required heat owing to their poor heat conductivity, while the more heat-resistant materials like titanium are too expensive for this purpose.

The prize-winning solution, found by the 10,000-man Kolbenschmidt Company in Swabia, which with a yearly turnover of 1.3 billion German marks [DM], is one of the leading developers and suppliers of engine and automobile industry, has now opened up the high-temperature field with marketable metals. When a material is no longer useful for a particular purpose, the Neckarsulm workers create a new one by combining materials. Implanted short ceramic fibers were found to strengthen the heavily taxed rim of the internal combustion chamber depression. "It would have been much too costly to have introduced the new material for the entire piston," Guenter Neite explained. Neite is associated with the Zentral Labor der Metallgesellschaft AG (Central Laboratory of the Metal Society) in Frankfurt, to which Kolbenschmidt AG also belongs, and he also participated in the development of the new piston. "It is much better to simply strengthen the areas where problems could arise," he continued. The rim of the depression is one such weak spot because the small transverse structural elements impede heat removal, thereby causing thermal tensions.

In normal diesel engine operation, each piston is exposed to alternate tension and pressure loads of between -25 and +25 megapascals at temperatures up to 350°C, or, in other words, to a load reversal of +/- a quarter of a ton per square centimeter about 35 times a second. With the new pistons, these values can rise to temperatures of up to 400°C and varying tension-pressure loads of between -35 and +35 megapascals.

In the area of the depression rim, the locally fiber-reinforced pistons consist of a so-called metal-matrix composite material, i.e., an aluminum-containing piston alloy—the matrix, and ceramic aluminum oxide (Al_2O_3) fiber admixtures. In this composite the aluminum alloy provides for sufficient heat conductivity with light weight, while the Al_2O_3 fibers assure the mechanical load capacity at high temperatures.

To achieve such synergies, in which the whole is more than the simple sum of its parts, is the goal of composite materials technology. But the problems begin as early as the selection of the materials to be combined. The basic consideration in the selection is whether the materials are mechanically compatible. Should the embedded matrix material, when heated, expand much more than the fiber reinforcements, then the fibers, and with them the desired strengthening effect, would be torn apart.

On the basis of practical requirements and its light weight, aluminum soon became the focus of attention in materials research. Aluminum oxide or aluminosilicate fibers are acceptable. Aluminosilicate fibers consist half of aluminum

oxide (Al_2O_3) and half of silicate (SiO_2), and are significantly cheaper than pure aluminum oxide. To be sure, as Guenter Neite admits, "We still have no positive results with aluminosilicates. They are out of the question for piston depression rims because the temperatures are simply too high."

On the other hand, the Toyota automobile company of Japan has already produced piston ring reinforcements out of it. Describing the future prospects in light of the Japanese developments, Neite says doggedly: "Aluminosilicates are therefore still in the running with us too."

Just as important as the mechanical compatibility is the chemical interaction. In bonding, the matrix alloy should not corrode or even destroy the fibers. Moreover, the alloy must perfuse the fiber material all over, in order that a true composite is formed. True adhesion only occurs when there is a division of mechanical forces between matrix and fibers under load, when a chemical reaction takes place during the perfusion.

"To achieve this," Gerhard Ibe of the Light Metals Research Institute of Vereinigten Aluminium Werke AG [VAW] explained, "one could, for example, enrich the interface with an admixture of magnesium to the aluminum alloy followed by an additional heat treatment, and let it react with the surface of the Al_2O_3 fibers. The adhesiveness is considerably increased in this way." But, just as in medicine, it is a matter of the correct dosage. "The interface reaction," Ibe continued, "should not just run on without limitation, because the fibers would be damaged if it did."

Another possibility of controlling the interface reactions (besides the magnesium enrichment) is fiber coating—a technique that is also used in CFK [carbon fiber-reinforced plastics]. But, of course, this kind of "interface engineering" means an additional processing step.

This composite of fibers and matrix alloy is produced by die casting. In this process, the metal melt is pressed in a mould body, in which the fibers are held together by a glue-like binding agent. Under the pressure, the binding agent permeates the melt. Vacuum pressure die casting is more costly. In this process, the mould cavity and the fiber mould are evacuated before the casting in order to remove all air and any lubricant fumes and to facilitate an air-tight and pore-free casting.

In both cases it is a matter of the fibers withstanding the casting process, undamaged and relatively uniformly distributed and bound. Nonetheless, to date, it has not been possible to avoid the fact that areas did form in which there were no fibers and therefore defective. "We suspect that there are weak spots in the fiber casting mould, which tear open under certain infiltration conditions," researcher Neite of Kolbenschmidt believes.

Unlike the air pockets or pores, which can be detected by X-rays, an uneven distribution of the fibers cannot be ascertained with certainty by means of nondestructive testing. "We would have to make a statistical process check," Neite explained. To ensure uniform quality,

material samples were taken out of the production line at certain intervals, cut open, and examined to determine whether the defects found in the spot check were beneath an acceptable frequency level.

Demanding requirements are put on the fiber casting moulds that Kolbenschmidt obtained from the Didier Werke AG. Normally, the fibers are just as long as a human hair is thick, namely, fifty to sixty micrometers, with a diameter of exactly three micrometers. During the production of the fibers, "shots," i.e., irregularly formed, sharp-edged lumps several hundred micrometers large, can get under the material and cause cracks in the composite. "Consequently," Guenter Neite emphasizes, "not a single shot should be present in the fiber casting mould." To prevent this from happening, every casting mould is analyzed by means of X-rays.

Despite the tricky production technology, other applications are in sight for the product, besides vehicle engine pistons. Thus, for example, the Aluminium Ranshofen GmbH in Austria, has developed track links with fiber-reinforced points for caterpillars and has recently begun practical testing of prototypes. Peter Degischer, the head of the research and testing facility at Aluminium Ranshofen reports: "Development has progressed nicely, but commercial production is just beginning." The breakthrough will only come when the improved performance capability is worth the higher price.

"We estimate that the new materials are twice as expensive as the conventional materials. Consequently, the track links have to last twice as long as before."

Another structural component that the materials researchers have in mind are engine connecting rods, which in combustion engines transfer the force of the pistons, and therefore the drive, to the crankshaft. The lighter they are, the less energy is lost in the self-motion of the connecting rods, and the less becomes the fuel consumption. Karl Ulrich Kainer of Clausthal Technical University puts it this way: "Fiber-reinforced connecting rods are the wish-dream of all the composite materials researchers."

Important leaps in performance have already been achieved. Static pressure tests revealed a significant increase in buckling strength from a six ton load in the case of a conventional connecting rod to 15 tons for rods reinforced with aluminum oxide fibers. But there is still a problem with fatigue-resistance. In the first fiber-reinforced rods produced, fractures appeared after only about two million load reversals.

With such rods, the average automobile would be disabled with a fractured rod after scarcely 20 hours on the road. Nonetheless, Gerhard Ibe of VAW's Light Metals Research Institute, where the rods are being developed, remains optimistic. He estimates that it will only be another year or two before the first prototypes are produced.

Meanwhile fiber-reinforced diesel pistons have been in mass production for a year and a half. IVECO, the Italian automobile producer, is the major buyer for both Kolbenschmidt and Mahle pistons. "Were it not for the U.S. exhaust regulations, these pistons would not be on the market," says Wolfgang Henning, Kolbenschmidt's head materials developer.

Because whoever is building trucks just for the European market would not have to use environment-friendly pistons. As usual, we Europeans have more lax exhaust regulations. Materials scientist Kainer comments: "I'm counting on our environmentalists."

FACTORY AUTOMATION, ROBOTICS

Italian Institute Develops 3-D Seeing Robot

92P60164 Rome ANSA in Italian 0526 GMT 29 Jan 92

[Received via ANSASERVICE Database]

[Text] The first robot capable of seeing and recognizing three dimensional objects such as a book or the face of a person has been made by the Institute of Scientific and Technological Research (IRST) of Trento. The system was developed in the context of the "Maia" project which is aimed at building a robot able to move anywhere, to respond to commands expressed in natural language, and to see the surrounding area.

The various components of this robot, with which Italy would achieve an absolute first in this area of artificial intelligence, have already been tested separately, but they still need to be integrated into the robot. One of the main functions is the artificial vision which up to now was one of the largest hurdles in the research.

The IRST robot is now, as a demonstration, carrying out the duties of an "electronic librarian." A person who wishes to obtain or return a book goes to the robot and makes a request.

Thanks to a recognition system based on the examination of the face (distance between the eyes and from them to the chin, width of the forehead, proportions of the nose and of the zygomata), the "Maia" robot knows whether the person in front of it is authorized or not to request books.

Italian Institute Presents MAIA Robotics Project Results

92MI0234 Turin MEDIA DUEMILA in Italian Jan 92 pp 24-31

[Article by Nicoletta Castagni: "That Robot Is a Real Homo Sapien (It Walks, Sees, Understands, Converses)"]

[Text] Only a slight hum announces the passing of two robots through the sunlit corridors. The people they encounter glance at them absentmindedly: They no

longer arouse curiosity since these robots are part of their everyday lives. Visitors on the other hand are highly amazed since very few research laboratories in the world have robots that move around, observe, speak, and learn. We have only to come a few hundred kilometers and not to the United States or Japan, but to Trent, at the Institute for Scientific and Technological Research (IRST) where, after five years, the MAIA [Advanced Model of Artificial Intelligence] project is beginning to come up with incredible results.

Luigi Stringa, founder and director of IRST, immediately had faith in the institute and dedicated his career to it, resigning as chairman of the Selenia-Elsag group. He watches the two machines with satisfaction as they appear to chase each other. However, instead of playing they are really testing various navigation techniques. Within a few days MAIA will be able to receive vocal commands, obey, go anywhere inside IRST, escort visitors and converse with them, and draw up daily reports in natural language on the missions accomplished.

The time has now come to integrate these separate functions by assembling all the components that have been designed and developed specifically to facilitate this integration. On the one hand, the robots are able to move freely around the corridors of the institute without representing a hazard to anyone. On the other, it is a continuous speech comprehension system, whoever the speaker, and voice recognition system. These are still located on a workstation that acts as a simulator where the cursor representing the robot on the monitor obeys the command and takes itself to the exact point. It should finally be stressed that MAIA interacts with humans in natural language and with a multimode approach, i.e. either by voice, keyboard, or touch screen. These are therefore exceptional results. Many people expressed their doubts when, in 1986, the first five-year plan of the newly-founded IRST was drawn up with the MAIA project as its prime target. Given the technologies available, an integrated system with many capabilities and "intelligent" behavior appeared to be an almost impossible challenge.

"We staked everything," said Luigi Stringa, making a first appraisal of the project, "on an extremely high level of integration between the various sectors of research into artificial intelligence. For decades these sectors had worked independently without knowing what the other sector's problems or solutions were. IRST's research teams were set up specifically to work together on a daily and ongoing basis. To facilitate this integration, we set ourselves goals which necessarily involved all the researchers who at present number around 100. Whether we were to develop a perfect expert system or an exceptional vision system or a voice recognizer which never made mistakes was irrelevant. We preferred to achieve not one, but all three of these things. Moreover, rather than perfecting the individual components, we focused on effective overall operating capabilities. For the time being the MAIA robot does not move particularly fast, but is able to move from one point to another in the

institute, with a partial type of programming. It understands everything even if these are simple, limited things, but its Italian is not flawless. The project has been enhanced by new variations such as the electronic "concierge" and the "librarian" robot, based on a vision system that may perhaps solve one of the most difficult problems in artificial intelligence, that of recognizing three-dimensional objects. In our case, the "electronic librarian" recognizes the books and faces of the people returning or requesting them. We can say that the robot, concierge, and librarian form the test bench for our integrated research. Their development for commercial purposes is not our main objective, although we are naturally very interested in the industrial developments of our results, whether overall or partial." Meanwhile, pending the final touches to these intelligent and coordinated systems, the visitor is inevitably and visibly struck by the prototypes. For the first time these prototypes have transformed into reality the expectations of decades of research and hard work at research centers worldwide.

The Walking Robot

The first version of the MAIA robot consisted of a robust, bulky platform purchased in the United States. It was the "skeleton" or mechanical part of the robot to which IRST added sensors, TV cameras, and microphones. It was later joined by a "younger brother," a small box with a TV camera on top, vaguely reminiscent of ET. Built by a firm in Trent that specializes in model aircraft, this robot, given its dimensions, is more agile than the first and can enter rooms and move around more freely. Although MAIA is now a reality, various navigation systems are being tested on the two robots since the project is far from being completed and new research is underway to attempt other solutions. The systems must be "reinforced," IRST researchers maintain, and every means should be tried to achieve higher degrees of efficiency to develop a robot that for the first time will be capable of moving in any environment.

MAIA is already half-way there. Equipped with a TV camera and eight ultrasonic sensors, the robot receives a vocal command to go to a given place within the institute. It has an internal map of IRST, albeit very approximate, in which only the corridors, doors and rooms with their occupants are marked. Not all obstacles are indicated since there are a large number of objects in the institute (chairs, tables, desks etc.) and it is virtually impossible to predict the flow of people in the corridors and offices. "The robot," explained Bruno Caprile, a researcher in the vision group, "translates the command into a sequence of actions, i.e. a series of reflexes. The instructions given by the researchers do not cover each step of the route the robot has to follow. These instructions are deliberately general." Following the order to "go along the corridor," MAIA initiates four reflexes: stop in front of an obstacle, avoid the side obstacle, keep away from the walls, keep in line with the corridor. This strictly hierarchical procedure is at the basis of the

robot's every movement and functions perfectly since MAIA never makes a mistake.

The robot can identify an obstacle at a distance of four meters: if it is frontal, it stops; if it is lateral, it goes around it. It brushes against plants, keeps away from photocopying machines, stops if someone absentmindedly crosses in front of it. Surprisingly enough, this reveals a basic ability to interact with unexpected events not traced on the map. When it senses a deep gap in the wall, it stops, understands that this is another corridor and turns or goes straight on according to where its target is located. It appears to be taking a stroll, never moving faster than half a meter per second, yet MAIA is now part of the surroundings at IRST. However, improvements must still be made to the robot's navigation system. Researchers at IRST are confident that within a year MAIA will be able to move around anywhere, even outside, after its programming is limited to the bare essentials. Work is therefore underway to acquire an understanding of how the robot can learn from its own mistakes and which type of knowledge comes from failure. Attempts are therefore being made to see whether the machine is capable of learning from a map of the environment not provided by humans. To achieve this, a proposal has been made to allow the robot to wander around the institute and to learn about the winding of the corridors and the location of rooms on its own and from its own mistakes.

Another step instead is to provide the robot with a large quantity of examples, i.e. memorize a set of images that illustrate the environment in which MAIA must perform. This system, which is being tested at IRST on a small modular robot, will back up the latest supposition whereby the intelligence of a machine does not lie in elegant algorithms but in its memory capacity. Luigi Stringa has formulated this hypothesis on several occasions, causing a reaction from the majority of artificial intelligence circles, an area still tied to the efficacy of complex operations. The director of IRST, however, does not conceal his intention to restrict algorithms as far as possible and to focus on storage capabilities. Tests conducted at the institute to date have borne him out, but it is still too premature to take a firm stand. This does not mean that one system excludes the other. IRST researchers are also developing a vision system that will work alongside the ultrasonic system already in use on MAIA. In this way the efficiency of the machine can be enhanced even further and will always give the robot a chance to confirm the information. IRST's activities are all carried out on its premises. The main building, to which another is being added to provide space for the ever increasing amount of research, houses a real microchip factory for the design and manufacture of highly sophisticated vision sensors. These devices are used solely for research and cannot be commissioned from other microprocessor manufacturers. This activity, however, has led to collaboration with the Sipar company in Rovereto, which goes to demonstrate how local industry can benefit from such advanced manufacturing processes.

A Robot That Can Understand Speech

One of the areas in which IRST has achieved its best results is that of character and voice recognition. An extremely powerful processing system capable of recognizing handwritten or printed characters at unbelievable speed was patented two years ago. A voice recognition system has also been developed in collaboration with the hospital of Trent for the automatic dictation of X-ray reports. "The system," as Gianni Lazzari, a researcher in the speech group, pointed out, "is similar to that already marketed by IBM, but its characteristic feature is that it does not have to be familiar with the voice of the person dictating. From the marketing viewpoint this does not make a great deal of difference since the IBM system requires only eight minutes of vocal training. In design terms, however, producing applications that are independent of the speaker and with continuous speech recognition, is a highly laborious task. This means that anyone, without training and without pausing between each word, is able to communicate with the machine."

MAIA does even more. It understands what is said to it, not via dictation but via speech, thanks to the very close collaboration between voice recognition and natural language experts. These are two branches of research into artificial intelligence which, on the surface would appear to be closely linked, yet which have evolved totally separately. The world of research is in fact often incomprehensible. By having experts from these traditionally separate fields work together, Stringa has achieved the results he hoped for: a robot that understands orders.

Although MAIA's range is still very limited, only 200 words relating to the environment at IRST, it can perform some elementary functions. Anybody visiting the institute from February on, will find a computer at the concierge's booth from which it can request information or ask where to find someone, the processor will reply. The dialogue may take place by voice or keyboard, but always in natural language. Then it is the turn of the mobile MAIA robot, ready to accompany the guest. "Where must I go?" asks the artificial voice of the robot. "Go to the secretary's office next to the office of Oliviero Stock (head of the natural language division)," and the robot moves toward the secretary's office in the artificial intelligence department, next to the office indicated. Tricky orders can be given, but MAIA never falls into the trap. While walking, information can be requested, through a microphone, on the persons and activities at IRST and the robot will reply promptly.

These conversations are simple and possibly slightly tedious. If the robot has not understood properly, it asks for further explanations and five minutes can be spent discussing the location of a photocopying machine. Only a year ago, however, nobody would have bet on these results. The system has still to be perfected however, also as regards exterior details. MAIA, in addition to understanding what is said to it, recognizes the speaker without making any mistake. Should this be someone

passing through, whose voice has not been memorized by the system, MAIA realizes this and the word "program" appears on the monitor, as if to say, "I do not know you, so please tell me who you are and what you want."

The work of perfecting the comprehension system even further involves the grammar, since the grammar currently used relates more to machines than to humans. Researchers at IRST are fully aware that the occasional user, from outside the institute, may find difficulties in interacting with the robot. It will therefore be necessary to simulate particular situations and reflect on how a person may request information from a robot by speaking normally. This may seem simple, in view of the results achieved, but psychological processes then come into play which require careful analysis.

The interaction facilitated by natural language may be used for a series of very important time-consuming activities within IRST. If the robot has to be reprogrammed, as is often the case since the two machines are constantly undergoing tests, hours of work and extreme precision are needed. By adapting the comprehension system to the range of operations required to program MAIA via vocal commands, it will be much simpler and faster to adapt the robot to the various needs.

The natural language used to develop the speech comprehension model is one of IRST's many glorious achievements. It is an expert system called "Alfresco" on fourteenth century Italian fresco painters, and permits a conversation to be conducted without having any knowledge of computers. This is a very appealing system, and a monitor that illustrates its potential was one of the few presented at the most recent IJCAI international artificial intelligence conference, held in Australia.

The type of language necessary to interact with the system is very flexible to the extent that one is amazed that it is a machine. The considerable complexity of the Italian language is taken into account, from the problems of pronouns to the continual references to other elements, from elliptic expressions to metaphors and idiomatic phrases. IRST's natural language system, developed by a large group of researchers led by Oliviero Stock, one of the leading Italian experts in the field and up to a month ago president of AIIA, the Italian artificial intelligence association, is based on various semantic levels. In fact, every phrase contains a large number of ambiguities and must be filtered and overcome gradually. "Alfresco" is linked up to a videodisc that contains a picture of all the works dealt with, historical cities etc., which visually integrate the information supplied by the expert system, hugely enriching the impact of this new form of learning.

Returning to MAIA, the natural language system has been modified as regards procedure, but the paradigm has remained the same. Interaction with the images, as in "Alfresco," will soon enter into operation. Subsequently there will be an actual link-up with the vision

interface. Meanwhile IRST is working on a semi-automatic translation system, thus increasing linguistic capabilities.

The "Librarian" Robot

IRST's second five-year program was launched in 1989, with new ambitious goals for the MAIA project. To everybody's surprise, including their own, scientists at the institute have achieved the results two years ahead of time, exceeding all expectations. The objectives were a real challenge to the most incisive problems of artificial intelligence and concern vision, i.e. machine recognition of human faces. Thanks to the new solutions adopted, they won the bet. The "librarian" robot can identify the face of the person handing in a book via its TV camera and by means of another system recognizes the volume and files it.

The mechanism behind the "electronic librarian" is considered to be a sort of "Gestalt recognition" system based on histograms. The system stores 55 faces and files four images of each face, for a total of 220 images. The system analyzes the parameters that produce a kind of fingerprint of the face: the distance between the eyes, the overall dimensions of the chin and forehead, the distance between the upper and lower parts of the face. Out of the total images contained in its memory, the robot makes only one mistake.

A similar procedure is used for book recognition. In this case the rate of error is nil and one second is sufficient for this highly complex operation. Initially, as Stringa explained, a solution was sought by making the system read the title-page of the book, but it then became apparent how difficult this approach was. There are no standards in the publishing world and a cover is primarily a graphic adornment to attract readers, even if the book is scientific. Neither can the author's name be used as a starting point since it is never printed in the same place and the many names that appear may often be the names of the publishers. In addition, the title, subtitle, type character change continuously, and the publisher and editor may be transposed. A massive task even for a supercomputer. The obstacle was overcome by a flash of genius. The system does not recognize the title, often hidden by other information, but the overall structure of the volume, which is never the same and always has some distinguishing feature. The histogram process measures this via simple detection, by analyzing the edges, the horizontal and vertical binding in relation to whether the book is available or not. For the time being 500 books have been memorized in the "librarian" robot using these parameters. The system is not at all expensive, and therefore suitable for many applications.

A Hospital Robot

As already underlined, by setting themselves goals for the MAIA project, researchers at IRST intended to provide solutions to the problems of artificial intelligence which appeared trapped in the vicious circles of a

lack of communication between branches of research, rivalry, and fideism. The escort, concierge, and electronic librarian robots have a certain commercial value, but if viewed exclusively with these functions they are still limited. The important thing is what they can achieve individually. Thus MAIA, the robot that walks and carries out orders given in natural language has become the center of a large-scale EUREKA [European Research Coordination Agency] project in which IRST is the leading participant and originator and which has been allocated 7 billion lire in funding. The project involves developing an articulated system for hospitals, comprising among other things a medicine trolley capable of moving freely inside the building, taking elevators, and serving rooms and wards. It will respond to vocal or keyboard commands in natural language. Speech comprehension also plays a part in the operating theater where the surgeon and his assistants will be able to give orders to workstations containing, for example, the patient's details.

Natural language, in addition to providing the solid basis for speech comprehension, will be developed in the very field in which it was first applied extensively at IRST, i.e. expert systems. "Alfresco" is only the first in a series aimed at the tourist market and can also be combined with an interface for virtual reality. Not only will the user see splendid pictures of monuments or landscapes, but will also have the sensation of being "physically" part of that environment. Vision and recognition of three-dimensional objects will lead to the development of security systems to cope with all types of break-ins. If facial recognition is combined with voice recognition, there is no possibility of error by the machine. Similar systems may be installed in firms, replace locks in houses, and be combined with identity numbers, such as for automated tellers, thus avoiding even the remotest threat of fraud.

These are only a few potential applications of the solutions developed at IRST's laboratories. Their effectiveness, in addition to their exceptional nature, is demonstrated by the 12 billion lire in funding that the EC has allocated to the institute and that should be doubled in the short term.

The Contribution of Tommaso Poggio

"IRST is one of the three leading research centers for artificial intelligence in the world." This statement was made by a world-renowned scientist, Tommaso Poggio, an Italian who has made his home in the United States and who is the father of artificial vision, the pride of the legendary MIT in Boston. Poggio is one of the most enthusiastic coworkers at IRST and does not conceal his satisfaction at the results that have been achieved and at the fast pace at which research is progressing.

We spoke with him after his meeting with the IRST vision group where he works several weeks a year. He openly states that it is not possible to carry out this type of research at MIT. Highly integrated projects such as

the mobile robot can be completed at Trent where cooperation is the very basis for success. This implies continuous exchanges whereas in a university laboratory researchers rotate very frequently. At MIT, Tommaso Poggio was able to test the highly powerful connection machines that emulate, thanks to connectivity and neural networks, the complexity of the human brain and hence vision, considered by scientists to be the primary sense that renders a machine "intelligent." When a robot interacts with the outside world, vision, as in humans, has the role of enriching, like no other sense, its capacity for learning. In Trent, Poggio does not have 65,000 computers in a network at his disposal, but he does not need them since the results of a machine's "intelligent" approach to reality can be achieved even without emulating the terrifying quantity and activity of neurons. "My work at IRST," said Poggio, "does not compete with what I do at MIT. There are still many roads to be tested and there is room for everything. In fact, the best part is always coming up with new challenges."

Stringa and Poggio both have all the elements for a profitable collaboration. Both are physicists who graduated from the University of Genoa and have therefore received the same training. Both scientists have been conducting research into vision for decades now, and while Poggio has published, Stringa has patented functioning systems. Two parallel paths that have met, immediately providing the expected results. Naturally for Stringa it was important to earn the enthusiasm of the major expert in the more problematic area of artificial intelligence. "The presence of Poggio in our institute," claimed Stringa, "has built an ideal bridge between the United States and Italy, between MIT and our center, to the extent that we are setting up joint ventures with the most famous scientific university in the world."

Poggio is not, however, the only world-famous scientist to work frequently on IRST's objectives. Another Italian who had the opportunity of carrying out advanced research for many years at the prestigious McGill University in Canada is Renato De Mori, one of the leading experts in voice recognition. He also actively collaborates with the speech comprehension group at IRST. Stringa does not conceal his desire to bring them both back to Italy on a full-time basis. Thanks to a research institute such as IRST, it is possible to work better than in the United States, even if the international standing of these scientists plays a specific part in the growth of the institute itself. IRST is now one of the leading research institutes in the world and perhaps one day the academic and personal links between our scientists and foreign counterparts will be broken. In the meantime the very new center in Trent has grown and become consolidated with exceptional results and without any fears of a brain drain.

Germany: BMFT Robotic Welding Project Results
92WS0282A Landsberg ROBOTER (EUROPEAN MARKET 1992) in German 1991 pp 62, 64

[Article by Prof. Dr.-Ing. Hans G. Baumann: "Robots Ogle Single-Piece Quantities"]

[Text]

Respectable Team Develops Welding Robots for Contracted Single-Piece-Quantity Manufacturing

Mannesmann Demag Huettentechnik, Cloos Schweissttechnik, the Rheno-Westphalian Technical College of Aachen, and the Fraunhofer Institute IAO of Stuttgart are participating in a BMFT project. This project is now bearing its first fruit. It proves that robotic welding systems for parts with a lot size of one are entirely possible.

A New Type of Robotic Welding System is to Improve the Single-Piece-Quantity Manufacturing of Welded Parts Starting in 1992.

Illustrations: Mannesmann Demag Huettentechnik.

As using known programming methods for sheet welding during single-piece production is not reasonable, this project developed a programming robot unit. With this unit, the worker can generate the welding program on the part to be welded independent of the welding robot unit in the plant. The essential subsystem of this programming robot unit is the programming robot. This robot is not driven but guided by hand. It has the same axes and movement potential as the welding robot. The programming robot method is particularly user-friendly. It is easy to learn, simple to use, and economical. In contrast to other methods, the programming time is very short. The welding robot can still operate during programming. The programming robot has a counterweight system. The use of low-friction bearings and special-purpose gear trains with very small frictional forces and mass moments of inertia results in ergonomic, easy operation of the programming robot.

Expanded Programming Strategy With the Hand Unit

Originally, plans called for only using the hand-guided programming robot for programming purposes. However, development work resulted in an even more ergonomic and economical programming strategy having an expanded programming concept in 1990. A manual programming terminal and a voice input/output system were also developed for programming the workpiece.

The worker first records points using the programming robot. This specifies the path of the robot during welding. Meanwhile, the user may enter geometry and process data and select pre-programmed needed program modules. The welder uses the manual programming terminal and optionally, the voice input/output system for this. In this way, the terminal, mounted on the programming robot, is a multi-purpose programming aid

for the user. The voice input/output system provides additional support to the programmer. The user can enter program commands easily using the voice input system while moving the programming robot unit.

Project Goals Achieved

A workstation with graphics terminal for further programming work is also part of the programming robot unit.

The development of this programming system achieved the original project goals of "Programming near the workpiece, work safety, and reduction of the loads placed on the welder," among others. This also attained the planned "Economy of the total welding robot system."

The main phase of the project expanded and improved the comprehensive welding robot design produced in the preliminary phase. These developments yielded a total system using semi-portal construction. Among other advantages, this design provided improved accessibility, safety technology, and greater flexibility than the originally selected system of bridge portal design. The semi-portal system with the top-mounted track carries the programming and welding robot units. The programming robot unit has a suspended programming robot with six axes arranged for motion in three directions. The welding robot unit has a six-axis welding robot that can move similarly. From a production view, the total design consists of the following areas:

- Assembly, tacking, and palletizing area;
- Programming area for A parts;
- Programming and welding area for B parts;
- Welding area for A parts, and
- Testing, machining after welding, and depalletizing area.

The total length of the new robot system for the welding of contracted single-piece-quantity manufacturing is about 34 m. The width is about 8 m and the height roughly 6.5 m. One positioner, known as the workpiece positioner, has two programmable axes. It is allocated to both the programming area and the welding area for A parts. The workpiece positioner for B parts has a programmable rotation axis. This positioner is located between the two areas for A parts. Each of the two workpiece positioners for A parts has two perpendicular rotation axes.

A Scaled-Down Programming Robot Only Welds Simultaneously

The operating speeds and accuracies of the workpiece positioners are matched to those of the robot unit. The welding robot control system operates both axes of the positioner. Because of this, the welding robot and workpiece positioner may move simultaneously.

Sensors recognize tolerances resulting from inaccurate preliminary component machining or distortion of the

individual sections of the part to be welded. They also simplify and accelerate programming, increase the functional safety of the welding robot, and relieve the load on the welder by reducing the machining of parts after welding.

The essential tasks of the sensors to be used in this project for sheet welding are recognizing the position and the course of welded joints in space.

Individual techniques developed while producing this comprehensive system are also suitable for use in other production systems.

NUCLEAR R&D

French Laboratory Develops Superconductive Particle Accelerator

92BR0167 Paris SCIENCES & AVENIR in French
Jan 92 p 11

[Unsigned article: "'Cold Speeds up Electrons'"]

[Text] Physicists at the Atomic Energy Commission (CEA) are quite proud of their latest baby, which has propelled them into the front running in the competition for particle accelerator technology for the 21st century. Its name, MACSE [Accelerator Module With Superconductive Cavities for Electrons], summarizes its objective and operating principle. To accelerate electrons, they are made to pass through a sort of tunnel, with positive and negative charges at its extremities which oscillate in a manner coordinated with the passage of the electron beam. Thus, the beam receives a small jolt depending upon the intensity of the current. However, if the current is too strong it heats up so fiercely that the intensities required would melt the device. Thus it has to operate in pulsed mode and with reduced accelerator fields.

From this came the idea of acceleration cavities made of a niobium-titanium alloy cooled to 1.8 Kelvin by liquid helium. This was experimented with by the CEA. The superconducting device causes the current to flow at zero resistance and can tolerate 10,000 amperes per cm². Moreover, it works! Still in the prototype stage, MACSE produced an electron beam of 10 million electronvolts on 17 October 1991. Philippe Leconte, head of the project, said, "This opens up the horizons in two directions for us. First, an electron beam of 15 GeV to "shake out" protons and investigate matter at the interface between particle physics and nuclear physics. This is in line with recommendations by the Academy of Science on constructing a national machine. Second, there is the TESLA project at the European Center for Nuclear Research (CERN) dealing with a linear electron-positron collider consisting of two units of 14 kilometers each to achieve 250 GeV on each side. Such a machine would need 20,000 MACSE-type cavities. There will be an interesting market for the industrialist who works with us."

Quark Experiments at HERA Facility in Hamburg

92WS0319A Zurich NEUE ZUERCHER ZEITUNG
(INTERNATIONAL EDITION) in German
22 Jan 92 p 48

[Article by Ulrich Straumann, Ralph Eichler, and Peter Truoeel (Physics Institute of Zurich University, Institute of Medium-Energy Physics of the Swiss Technical University): "The H1 Experiment on the Electron-Proton Storage Ring]

[Text] *Six years after its initial planning, the H1-detector, built with the participation of Zurich universities, went into operation in the HERA ring in the German Electron Synchrotron (DESY) in late 1991. The electron and proton beams intersect in the center of this instrument, the reaction products of occasional collisions are carefully recorded, and the structure of the particles and forces involved in these previously unattainable high energies are investigated at a spatial resolution about 50-times better than ever.*

Electron Scattering on Protons

The electron scattering experiments at the HERA facility are designed to broaden our understanding of the internal structure of protons. Similar investigations in the 1960s, carried out in Stanford at smaller energies, taught us that these components of atomic nuclei consist of three charged quarks held together by a "strong" force. Given the earlier resolution, the quarks appeared as point-like particles. Put more precisely, their extension was limited to 10⁻¹⁷ m or one one-hundredth of the proton radius.

The aforementioned strong force, which binds the quarks together to a proton, has been described by the theory of quantum chromodynamics (QCD). The force quanta are called "gluons," just as photons are the quanta of the electromagnetic forces. For a short time, quark-antiquark pairs and gluons can be created and again destroyed inside the proton, so that the interstice likewise possesses a kind of structure.

What are the properties of QCD forces? How do the pulses of the quarks and the gluons propagate? Can the density increase limitlessly, or is there a saturation effect? Do heavy quarks also enter the picture? But most importantly, is HERA also being confronted by the question that has occupied so many thinkers throughout western cultural history in a similar way, namely, do the tiniest indivisible component particles composing matter actually exist? Are quarks the answer? Or are quarks themselves composed out of even smaller particles?

HERA as an Electron Microscope

The method of measurement used at the HERA facility adopts the principle of the electron microscope. However, the wavelength and therefore the energy of the electrons used for the investigation has to be adjusted because it

determines the resolution, i.e., the extent of the smallest perceptible structure. To find new answers to the questions posed, the energy has to be increased as far as possible. If the yield of scattered particles could be organized according to direction and energy by means of an appropriate detector, conclusions could be drawn as to the dimensions of the scatterer and its composition, just as conclusions can be made as to the color and form of an object from its image created by an optical instrument.

To analyze the collision process, besides the scattered electron (which can also be transformed into a neutrino), quarks and gluons can also be referred to in the H1-experiment. Upon exiting the proton, the quarks and gluons are transformed into dense concentrations of neighboring particles, so-called "jets," which leave their traces in the detector. At the HERA facility, when electrons with an energy of 30 GeV collide with contrarotating protons with an energy of 820 GeV, the spatial resolution capability improves by a factor of 50. Should another layer of elementary structural elements be concealed beneath the quarks, it would be revealed at the HERA facility, providing it were not deeper than 10^{-19} m.

The H1 Collaboration

In order to make the best use of the capabilities offered at HERA, in 1985 about 200 physicists from ten West and East European countries, the USSR, and the U.S. gathered together to collaborate on the H1 experiment. This collaboration resulted in the proposal to build the apparatus which is now in place. As in most modern experiments in particle physics, chiefly three components serve to verify the reactor products, namely, trace chambers, calorimeter, and myon detectors. The traces of ionizing particles can be tracked in the internal chambers individually with an accuracy of about 0.1 mm.

The high particle density in the jets require delicately distributed measuring points. When the energies are not too high, the pulse and charge of each trace can be determined from the orbital curvature in the magnetic field of the coil. Individual particles or jets of higher energies are decelerated in the steel and lead plates of the calorimeter. Liquid argon (-186°C) circulates between the plates, and the ionization charge generated there represents the mass for the total energy of these particles. Finally, myons pass freely through the calorimeter and coil and are identified outside by means of special chambers.

The uneven incident energies of the two beams create an asymmetry in the spatial distribution of the escaping reaction products. Consequently, the detector in the proton direction is particularly massive and delicately instrumented. Jets and electrons too can only escape through the vacuum chamber for entering and exiting beams, in all other cases the detector is shut off as hermetically as possible in all directions. This is primarily important for the creation of the energy balance,

from which the transported energy from the neutrinos that are not interacting in the detector can be determined. The entire detector system shows a volume of $12 \times 10 \times 15 \text{ m}^3$ and a weight of 2,800 t.

The Role of the Zurich Universities

Two of the orbiting 220 beam packets intersect in the collision center every 10^7 seconds. The 270,000 electron measuring points of the H1-detector create a maximum information flow of 3 terabytes a second. In order to reduce these data sets to a mass of about five events (0.5 Mbytes) a second, which can be managed by the data storage and further analysis stages, various fast, partially parallel, partially consecutive, programmable electron filters are required.

The Physics Institute of Zurich University and the Institute for Medium-Energy Physics of the Swiss Technical University are participating in this project. Swiss industry has developed and delivered refrigerating equipment and superconducting magnets as well as fast processors for data acquisition and processing. Doctoral candidates and other researchers at Zurich universities have found innovative and original solutions in the development of the trace chambers, in the development of application-specific integrated circuits (ASIC) in combination with programmable logic cells (LCA), and in the development of lavish software packages. These projects have been generously promoted by National Fund, the Schools Inspectorate, and especially by the early engagement of the Educational Administration of the Zurich Canton.

QCD-Forces and Heavy Quarks

Initially in this long-term project, emphasis will be put on measuring the structural functions which describe the states of motion of the quarks and gluons in the proton under the influence of the QCD-forces. Later investigations will treat, for example, heavy, type-c ("charm") and type-b ("bottom") quarks, which *a priori* do not occur in the proton. They are generated by the fusion of gluons with the photons emitted by the incident electrons. The rare and forbidden decays of bonded quark-antiquark states (mesons) with c-content are especially suited to find deviations from the accepted model for the electric-weak interaction for the so-called standard model.

Other exotic states, that necessitate an expansion of this model as, for example, excited, heavy electron states, lepto-quarks (bonded states of electrons and quarks), supersymmetrical partners of the known leptons (electrons, myons), and quarks can likewise be recognized by their special signatures, in the event they exist. Such investigations will require a measurement time of about five years however.

Testing To Begin on European Synchrotron

92WS0371C Paris LE MONDE in French
18 Feb 92 p 14

[Article by Jean-Francois Augereau: "The Grenoble Synchrotron Is Fired Up for the First Time"; first paragraph is LE MONDE introduction]

[Text] When technicians have adjusted the machine and minutely inspected its alignments for the very last time, European synchrotron (ESRF) officials will inject the first bursts of electrons into its large storage ring, during the daytime hours of Monday, 17 February. The synchrotron is located between Drac and Isere, at the tip of the peninsula formed by the Grenoble scientific polygon.

The first startup tests of the large storage ring of the European synchrotron in Grenoble (ESRF) should begin this week. Electron packets carrying energy of 6 billion electron volts (6 GeV) will calmly intersect with each other in the circular ring that runs 850 meters long. They will be traveling at nearly the speed of light, or about 300,000 kilometers a second, and will give off their first light¹. Indeed, synchrotron radiation is an exceptional light source—a sort of scalpel for dissecting matter.

Long considered an interference effect of particle accelerators, this unique radiation is produced when the electrons react during strong acceleration along a circular path. The reaction causes them to lose a part of their energy by emitting a photon beam tangential to the path. The beam produces a source of light that ranges from ultraviolet to X-ray.

Ahead of the Americans and Japanese

When exploited and amplified, the phenomenon can be used to create extremely brilliant and well-focused light sources, which are highly useful in studying the microstructure of matter at the atomic or molecular levels. The synchrotron opens up unparalleled opportunities for researchers to determine the structure of biological molecules (proteins and viruses), detect microdefects in solids (alloys, metals, semiconductors), study the arrangement of amorphous materials such as glass, understand chemical catalytic processes, or X-ray blood vessels.

These possibilities certainly point up the value of the new European machine, which cost Fr2,200 million. The synchrotron was financed primarily by France (34 percent), Germany (24 percent), Italy (14.5 percent), and Great Britain (12.5 percent). The two-year lead that the ESRF has over its nearest competitors (see LE MONDE 15 May, 1991) further boosts its value. The synchrotron is still scheduled to be put into operation in mid-1994. The 7 GeV machine that the Americans are building at the National Argonne Laboratory not far from Chicago, and which is called the Advanced Photon Source (APS), will not be up and running until 1996 at the earliest. Japan's

8 GeV machine, the Spring-8 (SP-8), is slated to be installed in Kobe; it will not deliver its first beams until 1998.

But the budget problems of the American APS and the siting problems of Japan's SP-8 may give the Europeans an additional respite. All in all, however, the advantage is a slim one considering the potential pitfalls of the extremely complex technology the machines use. From that perspective, the six-month lead that the ESRF's promoters have already gained on their scheduled start date may prove very welcome.

Footnotes

1. A first, small linear accelerator produces the electron packets, which a second circular accelerator brings to an energy of 6 GeV. Using that method, 3,500 packets are introduced into the large storage ring, where they can travel non-stop for several hours before being used.

TELECOMMUNICATIONS

Dutch Government Subsidizes 15 Communications Projects

92BR0210 Rijswijk POLYTECHNISCH WEEKBLAD
in Dutch 16 Jan 92 p 3

[Article by Gerard van Nifterik: "Eleven Million Guilders for Data Communications Projects"]

[Text] Last week, Minister of Economic Affairs Andriessen announced 15 pilot projects in the area of "telematics" [computerized] communications which are eligible for subsidies. These programs, which will receive 11 million Dutch guilders in 1992, are to lead to the breakthrough of data communications in our society.

If Minister Andriessen were to have it his way, telematics would become the largest business sector in the Netherlands: a kind of crossroads combining such sectors as economics, communications, information technology, and many others. Supermarkets, store chains, medical insurance companies, live stock traders, and even the Dutch railroad service (NS) are all jostling to flood our society with smart cards. However, this cannot be done in an instant. Obviously the development and implementation of these chip card ideas requires money. According to Andriessen, a financial injection is needed to get out of the chicken and egg situation; in other words, a situation where users are waiting for sufficient applications while services suppliers are waiting for sufficient users.

There is a lot more involved than the advent of smart cards, although this is likely to be the most spectacular application from the consumer point of view. The minister is also providing subsidies for multimedia applications, the protection of information systems, and product data interchange.

As a matter of fact, last week the VOLKSKRANT newspaper reported that several projects had already secured funding even before the subsidies were approved. With or without subsidies, the business community would have started the programs in any case. Therefore, the newspaper report argued that government funding was not really needed, whereas, according to Andriessen, it indicated that the right projects had been selected, since they had a sufficiently large potential user base.

Surveillance Fee

Undoubtedly, forthcoming telematics developments will fundamentally change social interchanges, and it is not surprising that the government wants to look over the shoulder of the business community. To a certain extent, subsidies would give it the right to claim supervisory control.

However, the development of data communications applications in the Netherlands does not depend only on pilot projects. Following an initiative by IBM, PTT [Post, Telephone, and Telegraph], and Philips, a Telematics Research Center is being set up at the University of Twente. The center has already received government support and several universities will also be involved.

Philips Italia Presents HD-MAC Laser Disc System

92MI0243 Milan *ITALIA OGGI* in Italian
31 Jan 92 p 14

[Text] A child is seated near a brightly colored pool; he is holding a book where the letters are clearly visible. These demonstrational images are making their debut on television, but their brightness is nothing like the images on the television screen at home.

Using this naturalistic document, the managers of Philips Italia presented the HD-MAC laser disc system at their Monza plant yesterday. With revenues of 2.0869 trillion lire, 1,050 employees, and 1.3 million television sets manufactured in 1990, more than 50 percent of all Italian production, Philips Italia's new disc (18 minutes per side) will be the ideal means to transmit programs in high definition, before transmission by TF-1, TV-SAT, and Olympus satellites begins.

"This is one of the first steps," stated Giulio Zanmarchi, technical director of the EC's EUREKA [European Research Coordination Agency] '95 project. Supported by 12 study groups, the French company Thomson, and us, D2-MAC was chosen as the standard for high definition broadcasting. "The first chance outside of research laboratories to enjoy the results of the HD-MAC will be the Winter Olympics in Albertville. At RAI [Italian Broadcasting Corporation] centers in Milan, Rome, Naples, and Turin, Alberto Tomba's downhill descent will be filmed live with 1,250-line TV images instead of the 625 in use until now. This will be repeated at the

Barcelona games. "All using a logic that is the complete opposite of the Japanese logic," stated Philips managers, "that does not want HD-MAC technology to be compatible with current standards, such as PAL SECAM." D2-MAC in a 625-line format is already widespread. Zanmarchi continued, "Apart from its compatibility, the effectiveness of Philips' HD-MAC lies in the 100 Hz frequency it uses. Images are more stable and the typical flickering of the television sets of the last generation is eliminated."

These advances in technology are clearing the way for digital television, which, according to the experts, will become available in the first decade of the 21st century. Instead, plans are to have HD-MAC on the European market between 1994 and 1995 at an average cost of 5.5 million lire. Its components will be manufactured in-house: from chips to printed circuits.

And what about the public that has PAL SECAM, the system used today? The solution is to apply a simple, economical converter to the television set. D2-MAC however, is already being used in various countries but is considered somewhat expensive: 7 million lire. This has led to some problems. In fact, according to some, technology comes out with new systems with a wide range of choices and prices. The buyer spends a large sum of money to keep up with the times and then may find himself with an outdated standard. "Nothing to worry about," stated Zanmarchi. "PAL-SECAM will survive for at least 15 years, and so will D2-MAC. And the further ahead we go, the more prices will fall." This also depends on HD-MAC's market penetration, reported to be 5 percent during its first years of existence. But the pessimism of the Japanese publication JEI does not leave any way out.

The 500 billion lire Phillips plans to invest in technology (1 trillion lire in all) will cost the public about 300 billion lire. This is the cost necessary for broadcasters to equip themselves with the new high-definition systems.

German Consortium To Equip CIS With Satellite Phone, TV System

92MI0262 Bonn *DIE WELT* in German 7 Feb 92 p 25

[Article by D. Thierbach: "Connection Only by Satellite—Pressing Need for New Communications Facilities in the Former Soviet Union"]

[Text] The telecommunications infrastructure is simply disastrous: About 200,000 locations in the former Soviet Union are not yet connected up to a telecommunications network. Existing switching systems employ 60-year-old technology, which gives extremely poor-quality transmission and which cannot even be extended using modern technology. Existing subnetworks are too inadequate to form a viable network structure and guarantee an efficient telecommunications service. Little more than a start has been made on a computer data transmission system. Officially there are 1,500 connections, mainly in urban agglomerations, while there are no

international links at all. A short-term improvement can only be achieved with a satellite-based network. A German-Russian team has thus devised "Romantis," a satellite communications network that can be rapidly installed, to meet demand at least in part. The network consists of three space satellites, plus a reserve satellite on earth, with ground stations.

According to western standards, the CIS needs 150 million telephone connections and 10,000 voice lines to other countries. By the year 2000, Romantis is scheduled to provide at least 60 million connections and to meet at least part of the demand for television channels.

"Its high flexibility means that channel capacity can be geared to regional and international traffic requirements," said Reinhard Schnabel, of ANT Communications, recently in Hildesheim. His firm, DASA [German Aerospace Corporation], and DBP [Deutsche Bundespost] Telecom make up the "Dante" consortium. "The network is configured in such a way that certain areas are linked together and communicate with other areas of the network sections via a ground station. Smaller network units can also be covered directly by satellite." The three orbiting switching exchanges are in different orbital positions and are equipped with adjustable antennae.

Each satellite illuminates a specific area to ensure that the whole territory of the former Soviet Union is covered. "In view of the political developments, it remains to be seen whether all three satellites will enter service at the same time or whether the system is to be implemented gradually." The adjustable antennae, combined with the correct orbital positions, means that, in addition to its primary purpose, this "flexible system" can also be used for communications with Europe, the United States, South America and Africa.

To make the most of the limited frequencies available, and to provide as efficient a service as possible, each satellite will use the same frequencies in different beams. All four adjustable antennae are designed both to receive and to transmit, using the same system parameters as in successful satellites like Astra, Eutelsat, or the DFS [German Telecommunications Satellite System] Kopernikus. The telecommunications payload consists of 24 active transceivers, each with a 72-megahertz band width, providing an overall transmission capacity of 36,000 speech channels or 48 television channels.

"In western-style traffic conditions, a satellite could handle more than 1 million telephone connections," said Reinhard Schnabel. A 2.5-tonne satellite is designed for a service life of at least 12 years. If all goes according to plan, the first Romantis satellite will be launched in 1995.

To take account of the different traffic density in the various regions, the communications network will consist of configurations that will either distribute signals on earth in a star-shaped pattern or have its ground stations interconnected, as in a grid. Five types of station models have been developed for use in the Romantis system,

with a view toward optimizing the overall network. Ground antenna diameters range from 0.7 to four meters. Stations with transmission facilities have amplifier output powers of between five and 240 watts.

Ground stations with 0.7 to 1.2-meter antenna diameters are mainly used for individual television reception and for one-way thin route traffic [Verkommunication], stations with 1.5-meter antenna host cable head stations that relay the signals. The largest station in the network, with a four-meter antenna and a 240-watt transmitting power, will be used for TV uplink and cable head stations for many channels. This station will be equipped with transmission and receiving facilities.

"Presentations and meetings with the national authorities concerned give grounds for hoping that the installation stage may begin before the end of 1992," said Reinhard Schnabel. He put the overall costs for the initial development stage of Romantis at between 2 and 7 billion German marks. "If fee income reflects western levels, we estimate that it will have paid for itself in seven years."

Thomson's High-Definition Television Sacrifices Image Quality for 16/9 Format

*92WS0371A Paris LE MONDE in French
19 Feb 92 p 20*

[Text] While France is rebroadcasting its first public high-definition television images, the French group Thomson is getting ready to expand its line of Cinemascope screens. Cinemascope screens follow the 16/9 format, rather than the current 4/3 one. Thomson launched the costly Space System, which measures 93 cm across diagonally, for 35,000 French francs [Fr] in February of 1990. In March it will market a new 83 cm set for less than Fr20,000.

Distributors such as GITEM, FNAC, and Darty have already ordered 500 of them. In early November Thomson will bring out an even smaller, 70 cm set for less than Fr12,000. All the new sets have one drawback: Unlike the Space System, they will never be able to receive high-definition broadcasts when the HD-Mac decoders come out. In fact, Thomson intends to make the most of the new 16/9 format, which it has priced modestly, at the expense of better picture quality. The company also argues that high-definition broadcasts shown on sets smaller than 93 cm offer no perceptible improvement in picture quality. Is that really so?

EUTELSAT To Increase Eastern European Coverage

*92WS0376B Paris AFP SCIENCES in French
13 Feb 92 p 13*

[Article: "EUTELSAT Accelerates Modification of One of its Satellites To Help East Europe"]

[Text] Paris—The European Satellite Telecommunications Organization (EUTELSAT) has decided to step up its participation in international aid to the former East Bloc countries by modifying (six months in advance) one of its next three satellites in such a way that it can be used for two-way connections between Central and Eastern Europe and the West to alleviate the telephonic isolation that is impeding economic growth, the organization announced on 12 February.

To do so, EUTELSAT has decided to modify its Eutelsat-II-F4 satellite, which is scheduled to go into orbit in late June aboard an Ariane rocket. The modifications will also be made to the fifth satellite of the series. Before the decision was taken at its latest board meeting, these modifications, primarily affecting the antennae, were scheduled to be made only for the Eutelsat-II-F5 and F-6. The modifications will make it possible to extend the coverage of the EUTELSAT network to that whole part of Europe starting in June or July, instead of in late 1992.

According to a EUTELSAT spokesman, the decision responds to urgent requests made by many western companies that want to establish telephone networks or services in the countries of Central Europe or the member states of the CIS [Commonwealth of Independent States] in order to facilitate creation of enterprises and trade.

The countries concerned have already authorized the installation of ground-based aerals that permit utilization of EUTELSAT satellites. Networks have been established between Vienna (Austria) and Tbilisi (Georgia), London and St. Petersburg, Rotterdam and Kiev (Ukraine), and between Germany and Moscow. Additional aerals are now being installed in Prague.

As a direct consequence of the improved communications with the former countries of the East, the European Broadcasting Union (UER) will merge in 1993 with its Central and Eastern European counterpart, the OIRT. The two will thus be able to serve almost all their members. The first phase of this operation will be the late 1992 transfer of UER traffic, which up to now has been handled through a Eutelsat-I satellite, to four of Eutelsat-II-F4's wide-band repeaters.

To boost the network's capacity in certain parts of Europe, the Eutelsat governing board asked the organization to make a detailed study of co-location of two Eutelsat-II satellites, which would provide the 40 television channels in one orbital position needed to meet the need.

EUTELSAT is currently operating a system of seven satellites to provide fixed communications (telephone, television, telex, data) and to support mobile ground stations throughout Europe.